1992

Environmental Assessment, Carter Mountain-Thermopolis 230-kV Transmission Line Project, Hot Springs County, Wyoming

U.S. Department of Energy

DOE/EA-0453

ENVIRONMENTAL ASSESSMENT

CARTER MOUNTAIN - THERMOPOLIS 230-kV TRANSMISSION LINE PROJECT

HOT SPRINGS COUNTY, WYOMING

U.S. DEPARTMENT OF ENERGY
WESTERN AREA POWER ADMINISTRATION
LOVELAND AREA OFFICE
LOVELAND, COLORADO

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EXECUTIVE SUMMARY

Introduction

The Western Area Power Administration (Western) is proposing to construct, operate, and maintain a new 230-kV transmission line between the Carter Mountain and Thermopolis Substations in northcentral Wyoming (Hot Springs County). The project area is shown on Map 2-1. This environmental assessment was prepared in compliance with the National Environmental Policy Act (NEPA) and the regulations of the Council on Environmental Quality and the Department of Energy, which is responsible for approval of the proposed action. The Bureau of Land Management (BLM) is a cooperating agency on the project and is also the Federal review agency responsible for granting rights-of-way (ROWs) across public land.

Purpose and Need

Western proposes to replace its existing 42-mile long Carter Mountain-Thermopolis 69-kV Transmission Line with a new 230-kV line. The line would be operated initially at 115 kV. Operation at 230 kV would depend on load growth, the need for increased transfer capacity to and from Montana, and construction of a Carter Mountain-Lovell-Yellowtail 230-kV line.

The existing Carter Mountain-Thermopolis 69-kV Transmission Line was constructed in 1940 by the U.S. Department of Interior, Bureau of Reclamation, with 1/0 copper conductor on wood-pole, H-frame structures without an overhead ground wire. Western provides Tri-State electrical service at the Hamilton Dome 115/69-kV Tap, the Gooseberry 69-kV Tap, and the Carter Mountain 115/69-kV Substation, which are all connected to the Carter Mountain-Thermopolis Transmission Line.

Extreme low voltages presently occur on Carter Mountain Substation's 115-kV electrical system when any segment of Tri-State's Carter Mountain Thermopolis 115-kV Transmission Line is out of service. Adequate electrical support is not available from Western's Carter Mountain Thermopolis Transmission Line for this situation due to the low voltage level, small conductor size of the transmission line, and the relatively high impedance (i.e., long length) of the 69-kV line.

The Carter Mountain-Thermopolis 69-kV line should be replaced because of the deteriorated condition of the wood pole H-frame structures. The line also lacks an overhead ground wire and

is subject to numerous outages caused by lightning. The line will have reached the end of its useful service life in 1991.

Alternatives

Proposed Action. Western proposes to remove the existing Carter Mountain to Thermopolis 69-kV transmission line between Western's Thermopolis Substation in Thermopolis, Wyoming, and Tri-State's Carter Mountain Substation and rebuild it to 230-kV standards, but initially energized at 115-kV. All 115-kV terminal facilities would be constructed within the existing substations, so no additional land would be required for the terminals. Along the segments where the line would be removed and not rebuilt, Western would relinquish interest in the easement and return all rights to the owners of the underlying fee title.

Western's proposed routing alignment, Route L, is described in Section 2.4, Identification of Alternative Routing, and Section 2.5, Comparison of Impacts for Western's Proposed Route and Alternatives.

Western's proposed route is 41.5 miles long. The proposed transmission line structures would be either single circuit lattice steel, wood-pole or steel H-frame, or single steel pole structures. Construction of the line would require approximately 1 year and is scheduled between spring 1993 and summer 1994. The peak construction work force is estimated to be 25 to 35 workers.

No Action. Under the No Action Alternative, no new transmission lines would be built in the project area. The existing 69-kV transmission line would continue to operate with routine maintenance, but with no provisions made for replacement.

The primary advantage of this alternative is that no new investment would be made. Additional environmental studies, design summaries, etc., would not be required. However, implementation of this alternative would result in unacceptable voltage levels during single contingency outages. There would be no backup service for Tri-State's existing 115-kV Thermopolis Hamilton Dome-Carter Mountain line, and the voltage problems at Tri-State's Carter Mountain Substation would continue under first contingency condition. The existing 69-kV transmission line would continue to be susceptible to numerous outages caused by lightning strikes and the structures would continue to deteriorate. The deteriorated condition of the wood poles may cause structural failures and unwarranted hazards to Western's maintenance crews and the general public.

Identification of Alternative Routing

The first step in the identification of alternative routes for the Carter Mountain-Thermopolis Transmission Line Project was to establish a project area encompassing the area from the Carter Mountain Substation in the northwest corner to the Thermopolis Substation in the southeast corner. The second step was to develop route selection opportunities and route selection objectives.

At this stage in the process, the first public scoping meeting was conducted in Thermopolis, Wyoming on April 3, 1990. The purpose of the meeting was to describe the project, purpose and need, preliminary environmental concerns, EA preparation, route evaluation and selection process, the NEPA process, project schedule, and to solicit input from the public. Concerns and questions were expressed regarding the operation of Western's existing 69-kV transmission line; the environmental inventory process; safety and reliability; and route location.

The third step in the route identification process was to develop and evaluate route links within the project area. In developing the 31 route links, the selection objectives and input received at the public scoping meeting were used. The fourth step in the process was to combine a series of links into complete transmission line routes between the Carter Mountain and Thermopolis Substations. The links were assembled into alternative routes for initial evaluation and comparison. A total of 12 routes (A through L) were defined.

The next step in the route evaluation process was to rank order each route (1 through 12) based on consistency with the objectives represented by each of the 33 environmental factors inventoried. Route K had the best score and was given a final rank order of 1.

As the final step in the route evaluation process, Western evaluated the 12 routes based on consistency with management objectives, economics, design and construction parameters, access to the Thermopolis Substation, and compatibility with future plans to energize the line at 230-kV. Western selected Route L as the proposed route for the Carter Mountain to Thermopolis Transmission Line Project.

The second public meeting was conducted at this point in the process on September 12, 1990 in Thermopolis, Wyoming. Western's proposed route was presented and compared to Western's existing 69-kV route. Comments were received regarding construction workforce requirements, wildlife concerns, safety, and system operation.

Comparison of Impacts for Western's Proposed Route and Alternatives

The environmental differences among alternative routes are, for the most part, minor. The environmental factors most responsible for the different rankings of Routes L and K deal with moderate and excessive slopes. Slope is a general measure of the potential for soil erosion. Western recognizes this potential and intends to implement construction and mitigation procedures that will limit or prevent soil erosion. Therefore, from an environmental perspective, Western views Routes L and K as being very comparable. The better entry into the Thermopolis Substation of Route L caused Western to select this route as its Proposed Action.

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1.0 PURPOSE AND NEED

1.1 Introduction

The Western Area Power Administration (Western) is one of five power marketing administrations within the Department of Energy (DOE) responsible for the transmission and marketing of hydroelectric power from federal dams in the United States. Western is responsible for the federal electric power marketing and transmission functions in 15 central and western states.

Western operates and maintains an existing electric transmission system between the southern Montana area and northern Colorado. The system's northern termination is at Yellowtail, Montana, and the southern termination is at Ault in northern Colorado. The basic transmission line structure used is H-frame wood poles. A considerable portion (about 75 percent) of Western's Yellowtail-Ault transmission system is over 40 years old, and the wood pole structures have deteriorated to the point where the system is in need of extensive rehabilitation or rebuilding. The remaining portion is about 25 years old and will reach the end of its useful life expectancy within 10 to 15 years. Although about 75 percent of the transmission lines have exceeded their expected service life, they remain integral and essential elements in the overall Wyoming-Colorado area's present and future bulk power system. Western is studying a program to replace or rebuild, at higher voltages, segments of the system over an extended period of time.

The Rocky Mountain area, including the Yellowtail-Wyoming northern Colorado area, has been identified by the National Electric Reliability Council (NERC) as being unable to meet transmission system reliability criteria. The area has experienced several major outages due to an inadequate transmission system. Additionally, it is a high-load growth area due to extensive energy development, circular irrigation system installation, and population growth. The addition of new transmission facilities is required to meet the area's needs and to meet reliability standards.

As the initial step in improving reliability to acceptable levels, Western initiated and participated in the Rocky Mountain Transmission Planning Study with all the major utilities in the Rocky Mountain Area to identify the long-term needs of the Wyoming and northern Colorado areas. The utilities that participated in the study included Basin Electric Power Cooperative; Black Hills Power and Light Company; Pacific Power and Light (PP&L); Platte River Power Authority; Public Service Company of Colorado; and Tri-State Generation and Transmission Association, Inc.

(Tri-State). Where possible, Western plans to coordinate its replacement program with the needs of these utilities to meet the area's load growth requirements.

This environmental assessment (EA) was prepared in accordance with the National Environmental Policy Act (NEPA) to assess the impacts of rebuilding a specific portion of Western's Yellowtail to Ault system in the Carter Mountain-Thermopolis area. In addition, Western has conducted a generalized study of the environmental impacts of using existing corridors in future replacement or rebuilding segments of the transmission system from Yellowtail in partnership with other area utilities to Ault. As the requirements are specifically identified for these additional line segments, Western will conduct in-depth environmental studies. In any case, Western proposes to construct any needed high-voltage transmission lines on the existing corridors wherever possible to minimize environmental impacts.

Western is proposing to construct, operate, and maintain a new 230-kV transmission line between the Carter Mountain and Thermopolis substations in northcentral Wyoming (Hot Springs County). This EA was prepared in compliance with NEPA and the regulations of the Council on Environmental Quality and the Department of Energy, which is responsible for approval of the proposed action. The Bureau of Land Management (BLM) is a cooperating agency on the project and is also the Federal review agency responsible for granting rights-of-way (ROWs) across public land.

1.2 Purpose and Need

Western proposes to replace its existing 42-mile long Carter Mountain-Thermopolis 69-kV Transmission Line with a new 230-kV line. The line would be operated initially at 115 kV. Operation at 230 kV would depend on load growth, the need for increased transfer capacity to and from Montana, and construction of a Carter Mountain-Lovell-Yellowtail 230-kV line.

The existing Carter Mountain-Thermopolis 69-kV Transmission Line was constructed in 1940 by the U.S. Department of Interior, Bureau of Reclamation, with 1/0 copper conductor on wood-pole, H-frame structures without an overhead ground wire. Western provides Tri-State electrical service at the Hamilton Dome 115/69-kV Tap, the Gooseberry 69-kV Tap, and the Carter Mountain 115/69-kV Substation, which are all connected to the Carter Mountain-Thermopolis Transmission Line.

Extreme low voltages presently occur on Carter Mountain Substation's 115-kV electrical system when any segment of Tri-State's Carter Mountain-Thermopolis 115-kV Transmission Line is out of service. Adequate electrical support is not available from Western's Carter Mountain-Thermopolis Transmission Line for this situation due to the low voltage level, small conductor size of the transmission line, and the relatively high impedance (i.e., long length) of the 69-kV line. The following describes why the Carter Mountain-Thermopolis 69-kV Transmission Line needs to be replaced.

1.2.1 Physical Problems

The existing Carter Mountain-Thermopolis 69-kV Transmission Line will be 53 years old when it is scheduled to be replaced in 1994. The normal service life of a wood pole is 45 years. Because of its age, most of the poles on the existing line are in an advanced state of shell rot for their entire lengths and circumferences to a depth of 1 to 2 inches. Shell rot is a progressive fungal condition in which the exterior, or "shell," of the wood poles deteriorates and ultimately crumbles and falls away. Shell rot creates a hazard to maintenance personnel climbing the wood poles and the potential for structure failures.

The existing 69-kV transmission line lacks an overhead ground wire; therefore, it makes the line very susceptible to lightning-caused outages. According to Western's operation and maintenance records, there was a total of 88 outages on this line during the January 1, 1985 to July 31, 1989 period. An acceptable number of lightning-caused outages for a typical transmission line is considered to be only 3 per year. Customers connected to this line have expressed concern about the excessive outages and have requested that the 69-kV line be operated "open" at Carter Mountain Substation to prevent outages to the oil pumps in the area. These pumps have to be manually restarted following each outage. Operating the line "open" means that the 69-kV line is the only source to the Carter Mountain loads. This does not meet Western Systems Coordinating Council (WSCC) criteria. WSCC sets operating and reliability standards for utilities throughout the western United States. WSCC criteria state that two electrical sources are required to major loads.

1.2.2 Electrical Problems

During peak electrical loads, if an outage occurs on Tri-State's Thermopolis-Hamilton Dome 115-kV Transmission Line, extremely low voltages occur on the electrical system between Hamilton Dome Tap and Carter Mountain Substation. These low voltages can result in damage to equipment and dropping of loads. Replacement of the Carter Mountain-Thermopolis 69-kV line with a 230-kV line initially operated at 115 kV would provide acceptable voltage during an outage of Tri-State's line. Furthermore, if Tri-State's 115-kV transmission line is out of service for any extended period of time, Western's existing 69-kV line cannot provide adequate backup service, because it would overload. The rebuilt line would be capable of providing this emergency backup service. Because of the low voltage and overload conditions, the transmission system does not meet WSCC criteria. WSCC requires that if any single

transmission element (i.e., transmission line or transformer) is lost, the transmission system would continue to serve customers at acceptable voltages and not overload.

The new Carter Mountain-Thermopolis 230-kV line would replace Western's deteriorated 50 year old wood pole 69-kV line between Thermopolis and Carter Mountain. The new line would be initially operated at 115 kV, but constructed for future conversion to 230 kV. Constructing the Carter Mountain-Thermopolis Line to 230 kV specifications (instead of 115 kV) would eliminate the need for the construction of a second new transmission line in the area at some future date. Western's planning studies have identified a future need to increase the electrical transfer capability between Yellowtail Dam Powerplant located at Yellowtail, Montana, and Wyoming. Western's Billings Area and Loveland Area offices would use this increased transfer capability to provide mutual assistance to each other. The ability to provide mutual assistance would allow an area with surplus hydroelectric generation (due to favorable hydrological conditions) to transmit power to an area with insufficient hydroelectric resources (due to adverse hydrological conditions). This concept of mutual assistance would significantly improve reliability and efficiency of electrical service and increase the reliability and flexibility of operations of Western's marketing program. If one area has insufficient resources, exchanges can be made with the area that has surplus resources.

The new 230-kV line would give Western the ability to serve future load growth. Since the line would be built for future load growth, converting from 115-kV operation to 230-kV operation would only require simple upgrades at the terminal substation. Rebuilding the existing 69-kV line to 230 kV also avoids building duplicate lines in the future.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 Description of the Proposed Action

Western proposes to replace the existing Carter Mountain to Thermopolis 69-kV Transmission Line with a line built to 230-kV standards (954 or 1,272 KCM ASCR conductor) between Western's Thermopolis Substation in Thermopolis, Wyoming, and Tri-State's Carter Mountain Substation. The line would be operated initially at 115 kV. At the Carter Mountain Substation, a second 115/69-kV transformer (37 MVA) would be added. This alternative will provide acceptable voltage levels during single contingency outages, provide backup service for Tri-State's 115-kV line, and correct maintenance and safety problems. This alternative will also provide for the future capability to transmit all of the generation at Yellowtail and increase the reliability and flexibility of operations of Western's marketing program.

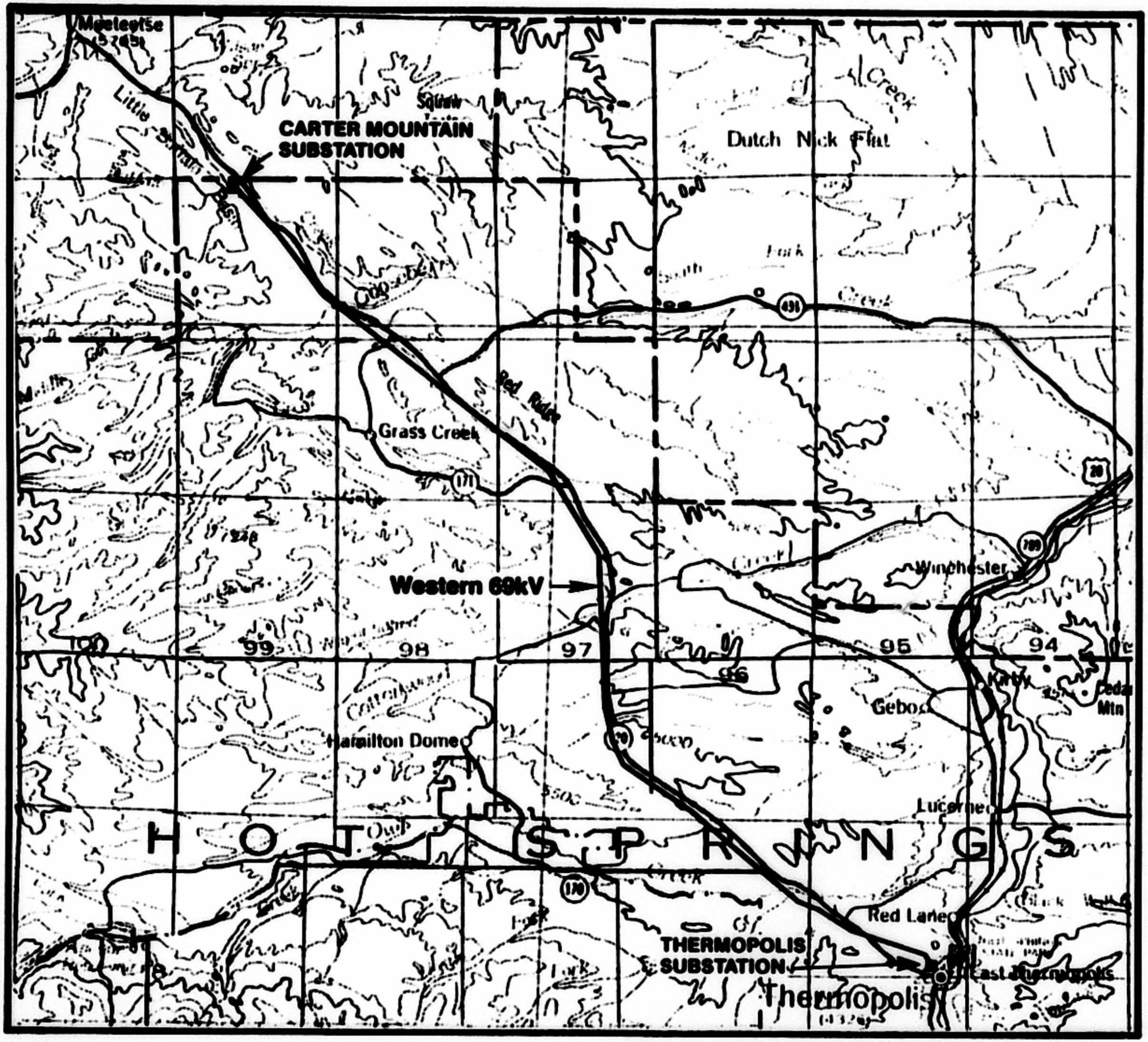
Map 2-1 shows the project area; Map 2-2 shows the existing 69-kV transmission line route and alternative routes that were identified during the alternative route selection process. This process is described in more detail in Section 2.4. Route L is Western's proposed route and the environmentally preferred alternative. New ROWs would be required for the transmission line; however, all 115-kV terminal facilities would be constructed within the existing substations, so no additional land would be required for the terminals.

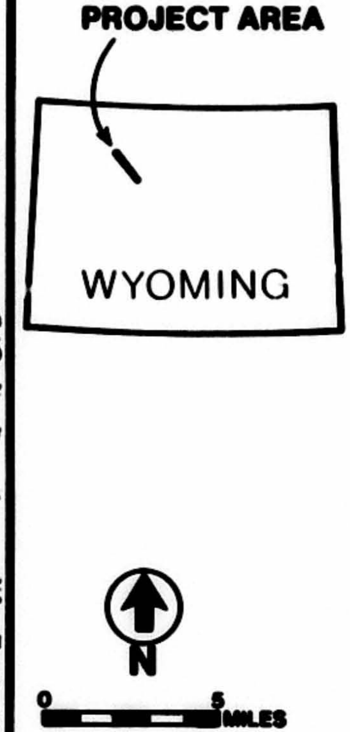
As part of the proposed action, Western would remove the existing Carter Mountain to Thermopolis 69-kV Transmission Line. The procedures for removal of the old line would be similar to those described for the proposed line in Section 2.1.1.5, Abandonment. The wood poles would be cut off at or below the ground to minimize disturbance. Certain poles may be left inplace as requested by the Bureau of Land Management (BLM) or Wyoming Game and Fish Department (WGFD). Along the segments where the line would be removed and not rebuilt, Western would relinquish interest in the easement and return all rights to the owners of the underlying fee title.

2.1.1 Transmission Facilities

2.1.1.1 Design Characteristics

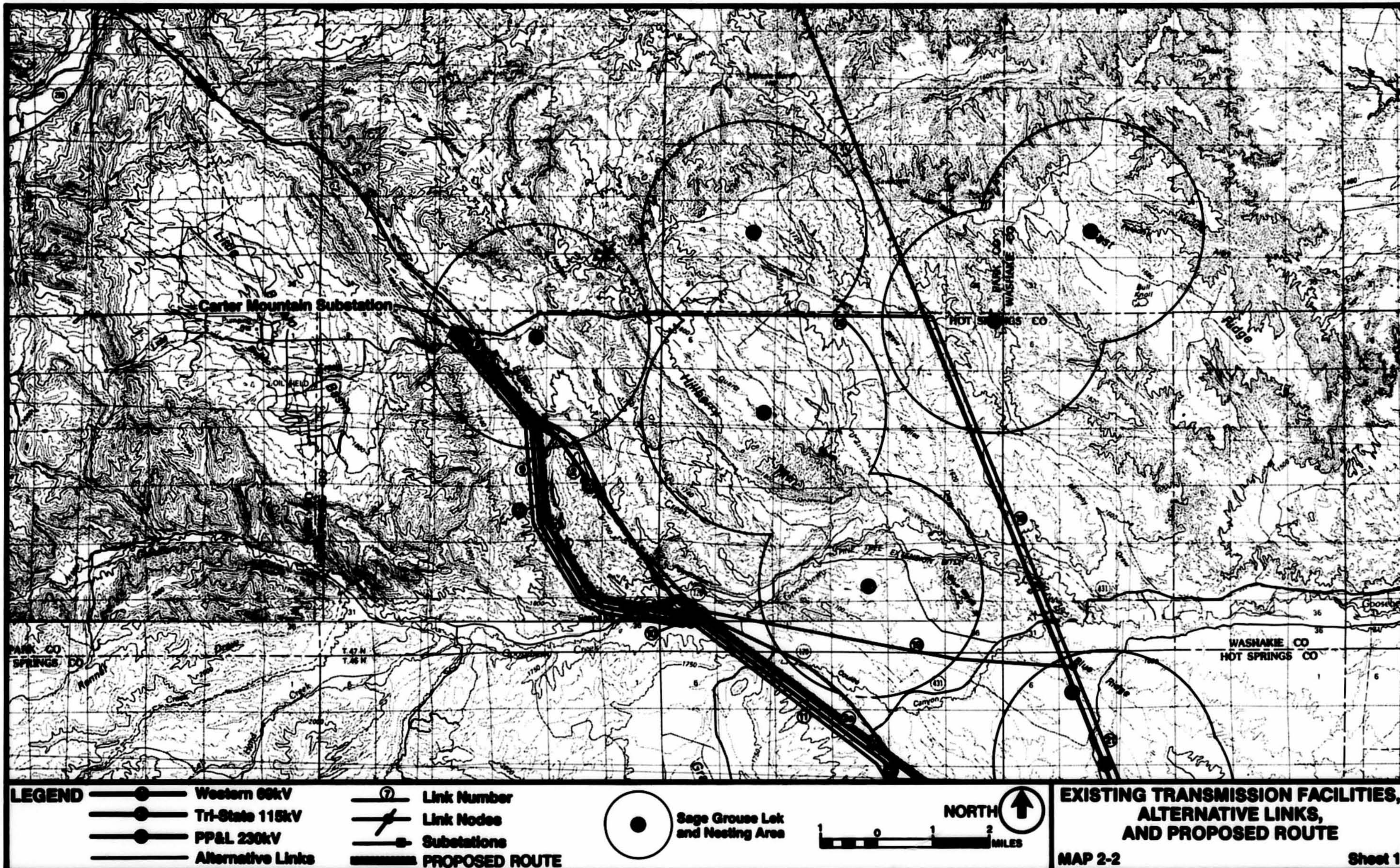
Physical characteristics of the proposed facilities are shown on Table 2-1. Western designs, constructs, operates, and maintains transmission lines to meet or exceed the requirements of the National Electrical Safety Code (NESC), U.S. Department of Labor Occupational Safety and





Map 2-1

Carter Mountain – Thermopolis Project Area



EXISTING TRANSMISSION FACILITIES, ALTERNATIVE LINKS, AND PROPOSED ROUTE

MAP 2-2 Sheet 1

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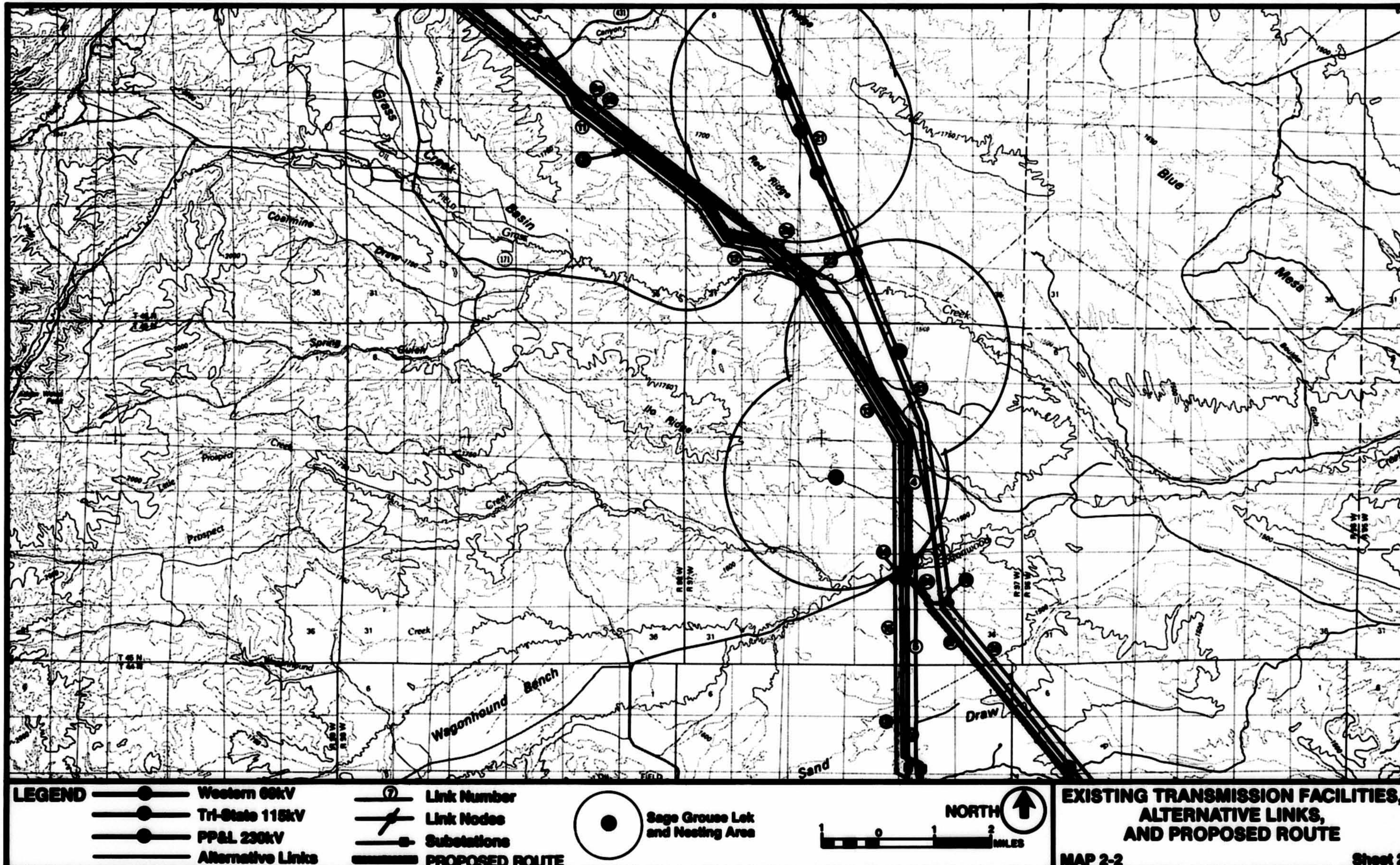
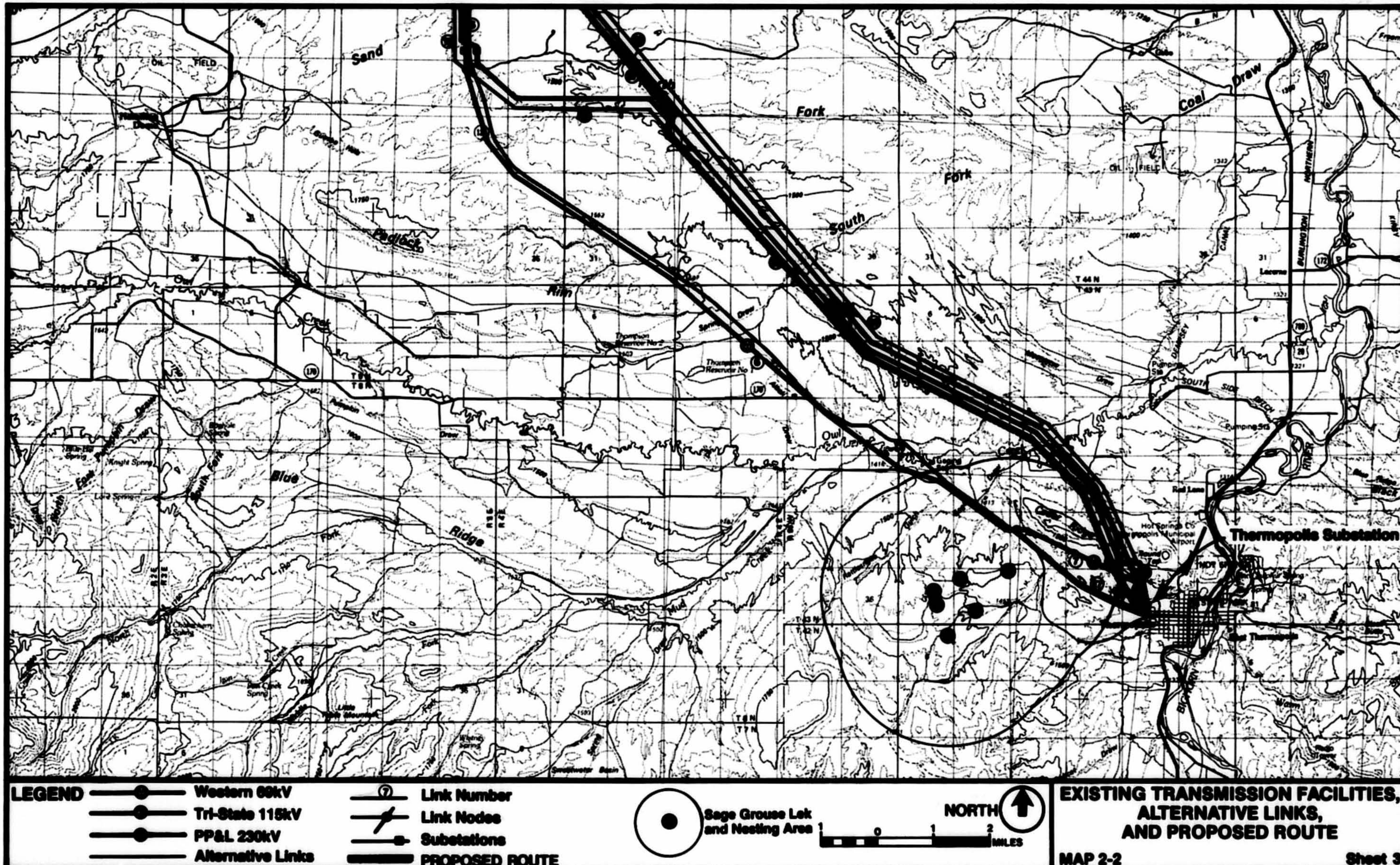

LEGEND
Western 69kV
Tri-State 115kV
PP&L 230kV
Alternative Links
Link Number
Link Nodes
Substations
PROPOSED ROUTE
Sage Grouse Lek and Nesting Area
NORTH
MILES
EXISTING TRANSMISSION FACILITIES, ALTERNATIVE LINKS, AND PROPOSED ROUTE
MAP 2-2
Sheet 2
Grass Creek
Basin
Coalmine
Draw
Canyon
Red Ridge
Blue
Mesa
Creek
Spring
Gulch
Ilo Ridge
Prospect
Creek
Wagonhound
Bench
Sand
Draw



EXISTING TRANSMISSION FACILITIES, ALTERNATIVE LINKS, AND PROPOSED ROUTE

MAP 2-2

Sheet 3

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TABLE 2-1

Typical 230-kV Transmission Line Design
(Approximate Figures)

Description	1 cct. H-Frame Wood Pole	1 cct. Single-Shaft Steel Pole	1 cct. Lattice Steel Tower
Voltage: line Design Initial Operation	230-kV 115-kV	230-kV 115-kV	230-kV 115-kV
ROW width	105 feet	95 feet	150 feet
Span between structures: average	700 feet	1,000 feet	1,200 feet
Span between structures: typical maximum	875 feet	1,200 feet	1,375 feet
Number of structures/mile (average span)	7.5	5.2	4.4
Height of structures: average	79 feet	115 feet	105 feet
Height of structures: typical range	65-97 feet	85-135 feet	80-120 feet
Structure base area (square feet)	45	10	1,600
Land disturbed by construction at each structure base (maximum in square feet)	6,500	6,500	6,500
Miles of line per conductor stringing site	2-3	2-3	2-3
Land disturbed at each stringing site	1 acre	1 acre	1 acre
Minimum ground clearance beneath conductor at 120°F	27.8 feet	28.3 feet	28.4 feet
Minimum ground clearance beneath conductor at 176°F[1]	25 feet	25 feet	25 feet
Maximum height of agricultural machinery that can be safely operated on the ROW	16 feet	16 feet	16 feet
Circuit configuration	Horizontal	Staggered vertical	Horizontal
Conductor size (circular mils)	954,000 or 1,272,000	954,000 or 1,272,000	954,000 or 1,272,000

[1]Maximum expected temperature.

Health Standards, and Western's own policies for maximum safety and protection of landowners, their property, and the public. All permanent improvements in proximity to the line, such as fences, gates, and metallic structures, would be grounded in accordance with existing codes.

The proposed transmission line structures would be either single circuit lattice steel, wood-pole or steel H-frame, or single steel pole structures. The structures are depicted in Figure 2-1. A horizontal member near the top of each structure would hold the insulators. Conductors would be hung from the insulators. The nonspecular conductors would consist of steel cable encased by aluminum strands. Insulators would be made of porcelain or a polymer material and would be light brown or gray in color. Overhead groundwires would be installed at the top of the structure to provide protection from direct lightning strikes.

2.1.1.2 Right-of-Way Needs

Typically, between 105 and 150 feet of ROW width would be needed depending on length of span and type of structure used for the 230-kV single circuit line to meet the clearance requirements of electrical safety codes, to provide working space for maintenance activities, and to protect buildings or other structures near the ROW from electrical hazards. Easements would be acquired for the new transmission line ROW and for roads and trails required for off-ROW access to and from the line. Easements across Federal and state land would be negotiated with the managing agencies, e.g., BLM. All easements across private land would be acquired in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646) and other applicable laws and regulations governing Federal acquisition of property rights. Landowners would be paid fair market value for rights acquired. Every effort would be made to acquire these rights by direct purchase; however, if the necessary rights cannot be acquired by negotiated agreement, eminent domain proceedings would be instituted to obtain these rights. All transmission line and access road easements acquired would provide for the payment of damages caused by the construction or maintenance of the line. Following construction, the ROW may be used by the landowner for purposes that do not create a safety hazard or interfere with the rights of Western.

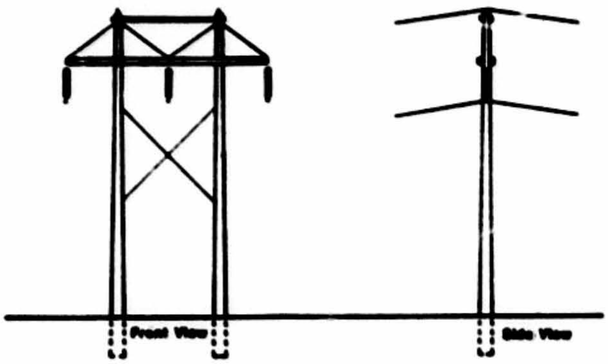
2.1.1.3 Construction

Construction of the proposed transmission line would include the following roughly sequential major activities performed by small crews progressing along a length of line:

- Surveying
- Access road upgrading
- Structure site clearing/grading

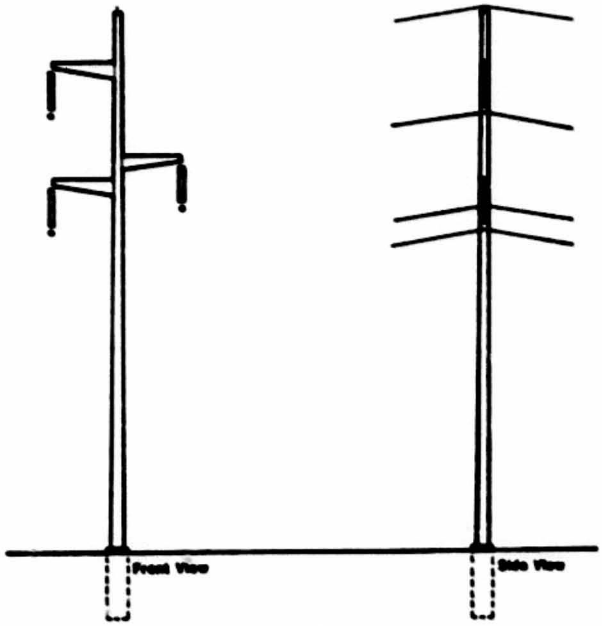
STRUCTURE TYPE:
230kV (1 cct.) WOOD H-FRAME

Average Height	79'
Height Range	65'-97'
Average Span	700'
Maximum Span	900'
ROW Width	105'



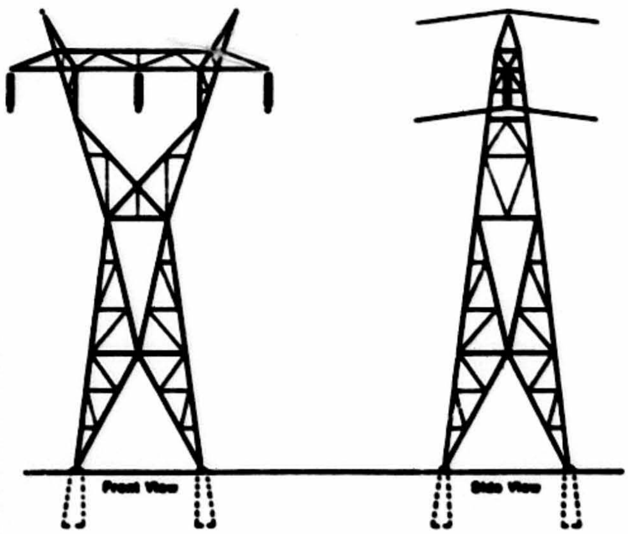
STRUCTURE TYPE:
230kV (1 cct.) SINGLE STEEL POLE

Average Height	115'
Height Range	85'-135'
Average Span	1000'
Maximum Span	1200'
ROW Width	95'



STRUCTURE TYPE:
230kV (1 cct.) LATTICE STEEL

Average Height	105'
Height Range	80'-120'
Average Span	1200'
Maximum Span	1375'
ROW Width	150'



STRUCTURE TYPE:
230kV (1 cct.) STEEL H-FRAME

Average Height	105'
Height Range	80'-120'
Average Span	1200'
Maximum Span	1375'
ROW Width	150'

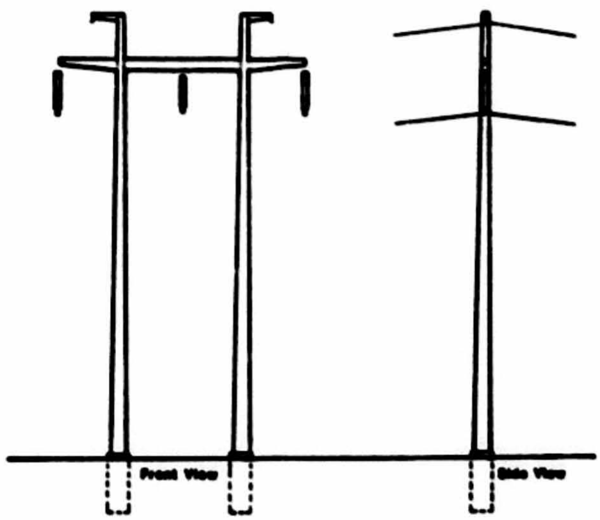


Figure 2-1. Transmission Line Structures

- Construction materials hauling
- Foundation excavation
- Structure assembly/erection
- Groundwire and conductor stringing
- ROW cleanup and restoration

The approximate number of personnel and equipment required for construction of the project is shown in Table 2-2. The peak work force is estimated to be 25 to 35 workers. Construction of the line would require approximately 1 year and is scheduled between spring 1993 and summer 1994. The areal disturbance associated with the construction of the project is shown in Table 2-3 by project activity.

Surveying. Survey work would locate the transmission line centerline, determine accurate profiles along the centerlines, locate structures, and determine the exact location and rough profiles of access roads.

Access. Access along the ROWs would be required for the construction, operation, and maintenance of the proposed transmission system. Access to each structure site by heavy construction vehicles and equipment would be required, but not necessarily along the entire length of the ROW between structures. Wherever possible, access to each structure and along the ROW would be by existing roads and trails. Since some of the new line would be built parallel to existing lines, road or trail access already exists to almost all of the potential sites of new structures. Sometimes these roads or trails are within the existing ROW and sometimes they detour from them. In some locations, particularly where crossing steep slopes, broken terrain, and drainageways, the existing roads and trails would require improvement (grading, widening, and culverting of drainage-way crossings) to allow passage of the required equipment.

Where no roads or trails exist, and where the terrain is gentle enough (below 12 to 15 percent slope) and soil conditions allow, access would be by overland travel, preferably along the ROW. Where this occurs, a trail would develop as a result of vehicle use. Where the terrain along the ROW is steeper than 12 to 15 percent, access to structure sites would be, wherever possible, by overland travel on more gentle adjacent terrain outside the ROW. Where no such adjacent gentler terrain exists within reasonable proximity, new graded access trails would be constructed. In many cases, new access trails would be short spurs leading from existing roads to structure sites.

In general, access trails would be routed to minimize damage to terrain and vegetation. Roads and trails would be arranged to cross streams and washes at right angles, wherever possible, and would normally cross without culverts, if this can be done without breaking down the banks.

TABLE 2-2

Typical Personnel and Equipment for Transmission Line Construction

Activity	No. of Persons	Equipment
Surveying	4	Pickup trucks
Access road construction and structure and site grading	2	Dozer or blade, pickup trucks
Clearing of ROW, construction yard, wire handling site, and structure site	2	Dozer or blade, pickup trucks
Materials hauling	8 - 12	2 tractor trailers, 2 hydrocranes, 3 pickup trucks, 2 flatbed trucks
Foundation excavation	4 - 8	2-4 tractors with augers, 2-4 pickup trucks, 2 backhoes
Structure assembly	6-12	1-3 hydrocranes, 4-6 pickup trucks, 1-3 flatbed trucks
Structure erection	4 - 6	1 crane (50- to 100-ton capacity), 2 pickup trucks
Groundwire and conductor stringing	5 - 10	Reel trailer, tensioner, puller, digger, winch truck, pickup trucks, high-reach dozers (bucket trucks)
Cleanup	3 - 6	Flatbed and/or pickup trucks
Seeding	3	Disc plow with tractor hydroseeder, pickup truck, flatbed truck

Note: Most of the activities above are expected to progress sequentially, and the peak number of people in the area at any time for transmission line construction is expected to be 25 to 35.

TABLE 2-3

Surface Area Disturbed during Construction of the Carter Mountain-Thermopolis Transmission Line Project

Project Component	Miles[1]	Short-Term Disturbance (Acres)	Long-Term Disturbance (Acres)
New access roads required[2]	5.0	7.3	7.3
Structure sites	N/A	46.7[3]	0.3[4]
Conductor stringing sites[5]	N/A	16.6	N/A
Staging areas (2 required)	N/A	10	N/A
Total	5.0	80.6	7.6

[1]Based on Route L with a total line length of 41.45 miles.

[2]New access road width is 12 feet; roadways would disturb pasture and rangeland; wetland and riparian areas would be avoided.

[3]Average span between H-frame wood pole structures is 700 feet and land disturbance during construction at each structure is 6,500 square feet. Single-shaft steel poles and lattice steel towers have longer average spans between structures, 1,000 feet and 1,200 feet, respectively. In either case, fewer structures would be required and land disturbance during construction would be 32.7 acres and 27.2 acres, respectively.

[4]Calculation based on 45 square feet of land for each structure base area, for a total of 313 structures.

[5]Average miles of line per conductor stringing site is 2.5 miles. Land disturbance at each conductor stringing site is 1 acre.

NA = Not Applicable.

If a stream is narrow with steep, high banks, then a culvert adequately sized to carry the heaviest construction equipment and large enough to carry the highest projected runoff would be installed. These trails would not only be used for construction, but would also be used throughout the life of the transmission line for operation and maintenance activities. Access trails would be 10 to 12 feet wide on the running surface and would be outsloped.

ROW Clearing. Clearing of trees is expected to be very limited. Clearing of other vegetation types would be performed where necessary to provide access for construction equipment. As part of this task, gates would be installed wherever an access road ROW crosses an existing fence. Gates would be kept closed but not locked, unless locks are requested by landowners.

Construction Yard and Material Handling Sites. It is estimated that two temporary construction yards of not more than 5 acres each would be required. These would serve as reporting locations for workers, parking space for vehicles, and for equipment and materials storage. It is anticipated that yard facilities, as needed by the construction contractor, would be provided at locations yet to be identified. The yard facilities would not be located on transmission line ROW.

Structure Site Clearing and Grading. At each structure site, an area would be disturbed by the movement of vehicles, assembly of structure elements, and other operations. A construction area measuring approximately 62 x 105 feet would be required for 230-kV structures.

Construction Materials Hauling. Construction materials would be hauled to the construction yards from the local highway or rail network and then to structure sites using the access roads described above.

Foundation Construction. In general, structures would be set directly into holes augured in the ground. The holes would be backfilled and compacted, and excess excavated material spread evenly around or adjacent to the site. For steel poles, concrete would be used as backfill. Steel lattice structures will require concrete foundations.

Structure Assembly/Erection. Erection crews would assemble the structures and, using a large crane, position them in foundation excavations or on foundations.

Groundwire and Conductor Stringing. Reels of conductor and overhead groundwire would be delivered to wire-handling sites spaced about every 2 to 3 miles along the ROWs. Level locations would be selected so little or no earth moving would be required. These sites may have to be cleared of vegetation and would be disturbed by the movement of vehicles and by other activities. The conductors and groundwires would then be pulled into place from these locations.

ROW Cleanup and Restoration. All structure assembly and erection pads not needed for normal maintenance would be graded to their original contour or to blend with adjacent landforms. Old poles, waste construction materials and rubbish from all construction areas would be collected, hauled away, and disposed of at approved sites. All disturbed areas not being returned to cultivation would be reseeded to minimize erosion. The intent would be to restore all construction areas as near as feasible to their original condition. Any damaged gates and fences would be repaired.

Safety Program. Western would require the contractor to prepare and conduct a safety program (subject to Western's approval) in compliance with all applicable Federal, state, and local safety standards and requirements, and Western's general practices and policies. The safety program would include, but not be limited to, procedures for accident prevention, use of protective equipment, medical care of injured employees, safety education, fire protection, and general health and safety of employees and the public. Western would also establish provisions for taking appropriate actions in the event the contractor fails to comply with the approved safety program.

2.1.1.4 Operation and Maintenance

The day-to-day operation of the line would be directed by system dispatchers in power control centers. These dispatchers use communication facilities to operate circuit breakers that control the transfer of power through the line. These circuit breakers also operate automatically to ensure safety, e.g., in the event of a structure or conductor failure.

Western's preventive maintenance program for transmission lines would include routine aerial and ground patrols. Aerial patrols would be conducted four times per year. Ground patrols would be conducted once a year to detect equipment needing repair or replacement (i.e., structures, insulators, and conductors). In addition, climbing inspections would be conducted on an on-going basis, with each structure being climbed and inspected once every 5 years. Maintenance may include repairing damaged conductors, inspection and repair of structures, and replacing damaged and broken insulators. In addition to maintaining the structures, conductors, and ROW, Western would maintain gates installed by Western on access roads and maintain the access roads to minimize erosion. Transmission lines are sometimes damaged by storms, floods, vandalism, or accidents and require immediate repair. Emergency repair would involve prompt movement of crews to repair damage and replace any equipment. If access roads are damaged as a result of the repair activities, Western would repair them as required.

Various practices may be used at structures and along the transmission line ROW to prevent undesirable vegetation. Because of the semiarid, sparsely vegetated nature of the project area, very minor and infrequent measures would be necessary to control vegetation. Herbicides would not normally be used within the transmission line ROW, unless requested by the landowner for the purposes of reducing noxious weeds around transmission line structures.

2.1.1.5 Abandonment

If the transmission facilities would no longer be needed, the transmission structures would be removed. The old ground wires, conductors, insulators, and hardware would be dismantled and removed from the ROW. The structures embedded in the ground would be pulled out, and structures embedded in concrete foundations would be removed along with their foundations. Wood poles would be cut off at or below ground level. Cranes, large trucks, and pickup trucks, as well as earth-moving equipment in a few of the steeper areas, would be required for efficient removal of the transmission line. Following abandonment and removal of the transmission line, any areas leveled for equipment required to dismantle the line would be regraded as near as feasible to their original condition. Similarly, areas disturbed and stripped of vegetation during the dismantling process would be regraded and reseeded to prevent erosion.

2.1.2 Standard Construction Practices

Western's Standard Construction Practices, which would apply to the proposed project, are presented in Table 2-4. Additional site-specific mitigation measures identified during the analysis of environmental impacts are described in Chapter 4.

2.2 No Action Alternative

Under the No Action Alternative, no changes would occur to the present Carter Mountain-Thermopolis 69-kV Line. The line would continue to operate with poles and structure components being replaced as necessary. Effects of the No Action Alternative are discussed in Section 4.15.

2.3 Alternatives Considered but Eliminated from Detailed Analysis

2.3.1 Inkind Replacement of the Existing Carter Mountain-Thermopolis 69-kV Transmission Line

This alternative would replace the existing Carter Mountain-Thermopolis 69-kV Transmission Line with a new 69-kV line. The line would be constructed from Carter Mountain Substation to

TABLE 2-4

Standard Construction Practices

1. The contractor shall limit the movement of crews and equipment to the right-of-way (ROW), including access routes. The contractor shall limit movement on the ROW to minimize damage to grazing land, crops, orchards, and property, and shall avoid marring the lands.

2. When weather and ground conditions permit, the contractor shall obliterate all construction-caused deep ruts that are hazardous to farming operations and to movement of equipment. Such ruts shall be leveled, filled and graded, or otherwise eliminated in an approved manner. Ruts, scars, and compacted soils in hay meadows, alfalfa fields, pastures, and cultivated productive lands shall have the soil loosened and leveled by scarifying, harrowing, disking, or other approved methods. Damage to ditches, tile drains, terraces, roads, and other features of the land shall be corrected. At the end of each construction season and before final acceptance of the work in these agricultural areas, all ruts shall be obliterated, and all trails and areas that are hard-packed as a result of construction operations shall be loosened and leveled. The land and facilities shall be restored as nearly as practicable to their original condition.

3. Water turnoff bars or small terraces shall be constructed across all ROW trails on hillsides to prevent water erosion and to facilitate natural revegetation on the trails.

4. The contractor shall comply with all federal, state, and local environmental laws, orders, and regulations. Prior to construction, all supervisory construction personnel will be instructed on the protection of cultural and ecological resources. To assist in this effort, the construction contract will address: a) federal and state laws regarding antiquities and plants and wildlife, including collection and removal, and b) the importance of these resources and the purpose and necessity of protecting them.

5. The contractor shall exercise care to preserve the natural landscape and shall conduct his construction operations so as to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work. Except where clearing is required for permanent works, approved construction roads, or excavation operations, vegetation shall be preserved and shall be protected from damage by the contractor's construction operations and equipment.

6. On completion of the work, all work areas except access trails shall be scarified or left in a condition which will facilitate natural revegetation, provide for proper drainage, and prevent erosion. All destruction, scarring, damage, or defacing of the landscape resulting from the contractor's operations shall be repaired by the contractor.

7. Construction roads not required for maintenance access shall be restored to the original contour and made impassable to vehicular traffic. The surfaces of such construction roads shall be scarified as needed to provide a condition which will facilitate natural revegetation, provide for proper drainage, and prevent erosion.

8. Construction staging areas shall be located and arranged in a manner to preserve trees and vegetation to the maximum practicable extent. On abandonment, all storage and construction materials and debris shall be removed from the site. The area shall be regraded as required so that all surfaces drain naturally, blend with the natural terrain, and are left in a condition that will facilitate natural revegetation, provide for proper drainage, and prevent erosion.

9. Borrow pits shall be so excavated that water will not collect and stand therein. Before being abandoned, the sides of borrow pits shall be brought to stable slopes, with slope intersections shaped to carry the natural contour of adjacent, undisturbed terrain into the pit or borrow area, giving a natural appearance. Waste piles shall be shaped to provide a natural appearance.

10. Construction activities shall be performed by methods that prevent entrance, or accidental spillage, of solid matter, contaminants, debris, and other objectionable pollutants and wastes into streams, flowing or dry water courses, lakes, and underground water sources. Such pollutants and wastes include, but are not restricted to, refuse, garbage, cement, concrete, sanitary waste, industrial waste, radioactive substances, oil and other petroleum products, aggregate processing tailings, mineral salts, and thermal pollution.

11. Dewatering work for structure foundations or earthwork operations adjacent to, or encroaching on, streams or water courses shall be conducted in a manner to prevent muddy water and eroded materials from entering the streams or water courses by construction of intercepting ditches, bypass channels, barriers, settling ponds, or by other approved means.

12. Excavated material or other construction materials shall not be stockpiled or deposited near or on stream banks, lake shorelines, or other water course perimeters where they can be washed away by high water or storm runoff or can in any way encroach upon the actual water course itself.

13. Waste waters from concrete batching, or other construction operations shall not enter streams, water courses, or other surface waters without the use of such turbidity control methods as settling ponds, gravel-filter entrapment dikes, approved flocculating processes that are not harmful to fish, recirculation systems for washing of aggregates, or other approved methods. Any such waste waters discharged into surface waters shall be essentially free of settleable material. Settleable material is defined as that material which will settle from the water by gravity during a 1-hour quiescent detention period.

14. The contractor shall utilize such practicable methods and devices as are reasonably available to control, prevent, and otherwise minimize atmospheric emissions or discharges of air contaminants.

15. The emission of dust into the atmosphere will not be permitted during the manufacture, handling, and storage of concrete aggregates, and the contractor shall use such methods and equipment as are necessary for the collection and disposal, or prevention, of dust

during these operations. The contractor's methods of storing and handling cement and pozzolan shall also include means of eliminating atmospheric discharges of dust.

16. Equipment and vehicles that show excessive emissions of exhaust gases due to poor engine adjustments, or other inefficient operating conditions, shall not be operated until corrective repairs or adjustments are made.

17. Burning or burying of waste materials on the ROW or at the construction site will not be allowed. The contractor shall remove all waste materials from the construction area. All materials resulting from the contractor's clearing operations shall be removed from the ROW.

18. The contractor shall make all necessary provisions in conformance with safety requirements for maintaining the flow of public traffic and shall conduct his construction operations so as to offer the least possible obstruction and inconvenience to public traffic.

19. Western will apply necessary mitigation to eliminate problems of induced currents and voltages onto conductive objects sharing a ROW, to the mutual satisfaction of the parties involved. Western will install fence grounds on all fences that cross or are parallel to the proposed line.

20. The contractor will span the riparian areas located along the ROW and avoid physical disturbance to riparian vegetation. Equipment and vehicles will not cross riparian areas on the ROW during construction and operation activities. Existing bridges or fords will be used to access the ROW on either side of riparian areas.

Western's Thermopolis 115-kV Substation. At Carter Mountain Substation a second 115/69-kV transformer (37 MVA) would be added. This alternative would provide acceptable voltage levels during single contingency outages and solve the maintenance and safety problems associated with the existing line. However, this alternative would not provide backup service for Tri-State's existing 115-kV Thermopolis-Hamilton Dome-Carter Mountain Line. It would not provide for any future capability to transmit all of the generation at Yellowtail on the west side of the East-West ties and would not increase the reliability and flexibility of operations of Western's marketing program.

2.3.2 Replacement of the Carter Mountain-Thermopolis 69-kV Transmission Line with a 115-kV Line

This alternative would replace the existing Carter Mountain-Thermopolis 69-kV line with a new 115-kV line with 795 KCM ACSR conductor. At Carter Mountain Substation a second 115/69-kV transformer (37 MVA) would be added. This alternative will provide acceptable voltage levels during single contingency outages, provide backup service for Tri-State's existing 115-kV Thermopolis-Hamilton Dome-Carter Mountain Line, and correct maintenance and safety problems. However, this alternative would not provide for any future capability to transmit all of the generation at Yellowtail on the west side of the East-West ties, and would not increase the reliability and flexibility of operations of Western's marketing program.

2.3.3 Underground Construction

Certain environmental impacts of underground lines are increased when compared with overhead lines of similar capacity. The decreased visual impact would be partly offset by the need for cooling system pumping and pressurizing facilities at intervals of about 15 miles along the line. Certain construction impacts would occur (and maintenance access would be required) along the entire length of the ROW as with a buried pipeline, not just at intervals as at the structure sites of an overhead line. These impacts would include greater hazard of soil erosion and disturbance to riparian vegetation and water bodies crossed. Underground transmission lines may have some environmental advantages over conventional overhead lines but have much higher costs. Visual impacts would be less; the ROW required is much narrower and, therefore, some land use impacts and ROW acquisition costs would be reduced; waterfowl losses from collisions with conductors and shield wires would be obviated.

The reliabilities of overhead and underground lines are probably comparable. While underground lines are immune to the effects of weather, they are susceptible to damage from geologic or subsoil instabilities and to mechanical failure of their cooling systems. A failure in an underground system often results in a power outage of several days or even weeks, since failures are difficult to locate and repair. In contrast, overhead line outages can often be repaired within hours.

Construction and operation costs are where the differences between underground and overhead lines become dramatic. A publication by the Bonneville Power Administration (U.S. Department of Energy [DOE] 1980) reports that underground lines (of the voltage being considered here) are generally seven to eight times as costly as comparable overhead lines. A more recent publication by the DOE reports that the cost of undergrounding a 230-kV transmission line would be roughly eight to ten times the cost of constructing an overhead system of comparable capability (DOE 1982). The reason for the extremely high costs of underground systems is primarily the need for elaborate cooling systems to dissipate the heat generated by high voltage lines.

Underground construction is generally used only at lower voltages, where the problems of heat dissipation are far less severe, or for distances of not more than a few miles in very intensively developed urban areas, extremely critical scenic areas, or areas where overhead lines would have a very severe impact on waterfowl from collisions.

For the above reasons, undergrounding of any of the elements of the Proposed Action is not considered a viable alternative.

2.3.4 Energy Conservation

As part of its marketing policies, Western encourages energy conservation through the elimination of wasteful, uneconomic, or unnecessary uses of energy, and through the use of renewable resources such as hydro, wind, solar, and geothermal energy sources. This policy is embodied in Western's Conservation and Renewable Energy (C&RE) Program (46 Fed. Reg. 56, 140 [1981]).

Energy conservation programs have the advantage of reducing energy consumption and have no significant environmental impacts. However, the purpose and need for the Carter Mountain-Thermopolis 230-kV Transmission Line Project cannot be met through energy conservation. The project is needed to increase transfer capacity and reliability. Since energy conservation only affects the demand for energy but does not provide the means for transferring electric power, it cannot be considered as an alternative action for meeting the stated need.

2.4 Identification of Alternative Routing

The first step in the identification of alternative routes for the Carter Mountain-Thermopolis Transmission Line was to establish the study area shown on Map 2-1. This study area places the Carter Mountain Substation in the northwest corner and the Thermopolis Substation in the southeast corner. The study area includes Western's existing 69-kV line, Tri-State's existing 115-kV line, and Pacific Power and Light's (PP&L) existing 230-kV transmission line.

The second step was to develop the route selection opportunities shown on Table 2-5 and then the route selection objectives shown on Table 2-6. The opportunities range from high to none depending on the feature being considered and its sensitivity to the construction and operation of a transmission line. The objectives contain items the study team wished to maximize, to avoid entirely if possible, or to minimize. The study area that remained following evaluation and refinement is shown on Map 2-2.

At this stage in the process, the first public scoping meeting was conducted in Thermopolis, Wyoming on April 3, 1990. The purpose of the meeting was to describe the project, purpose and need, preliminary environmental concerns, EA preparation, route evaluation and selection process, the NEPA process, project schedule, and to solicit input from the public. Concerns and questions were expressed regarding the operation of Western's existing 69-kV transmission line; the environmental inventory process; safety and reliability; and route location.

The third step in the route identification process was to develop and evaluate route links within the study area. In developing the 31 route links shown on Map 2-2, the selection objectives shown on Table 2-6 and input received at the public scoping meetings were used. Each link was then inventoried for consistency with the selection objectives and the results were tabulated.

The fourth step in the process was to combine a series of links into complete transmission line routes between the Carter Mountain and Thermopolis Substations. The links were assembled into alternative routes for initial evaluation and comparison. A total of 12 routes (A through L) were defined (see Table A-1 in Appendix A). These included routes using Western's existing ROW and paralleling Tri-State's and PP&L's existing lines.

Table A-2 presents a summary of the environmental factors associated with the 12 alternatives for the Carter Mountain-Thermopolis Transmission Line. The next step in the route evaluation process was to rank order each route (1 through 12) based on consistency with the objectives represented by each environmental factor shown on Table A-2. For example, if the objective was to maximize the amount of the route crossing rangeland, the highest route (in miles) would be ranked 1, while the lowest would be ranked 12. If two routes had the same value for a factor,

TABLE 2-5

Route Selection Opportunities

High Opportunity Areas

- Rangeland and uncultivated areas in cropland areas.
- Western's existing 69-kV line.
- Tri-State's existing 115-kV line.
- Pacific Power and Light's existing 230-kV line.
- Abandoned highway ROW northwest of the Thermopolis Substation.

Limited Opportunity Areas

- Irrigated cropland areas.
- Improved ponds for wildlife use.
- Sage grouse production areas.
- Active prairie dog colonies.
- Burrowing owl nest sites.
- Areas containing the Allen's thirteen-lined ground squirrel.
- Wild horse areas.
- Floodplains.
- Pronghorn migration routes (seasonal).
- Potentially unstable soils (e.g., steep slopes).
- Known areas of recoverable mineral resources (e.g., oil or gas wells, sand and gravel pits).
- Areas within the limits of a city.
- Areas zoned for residential development.

TABLE 2-5 (Continued)

Low Opportunity Areas

- Crucial winter range for pronghorn and mule deer (seasonal).
- Pronghorn fawning areas (seasonal).
- Riparian areas.
- Wetlands greater than 10 acres in size.
- Areas within 0.5 mile of nesting or roosting areas of the golden eagle and other raptor species.
- Historic or prehistoric sites eligible for the National Register.
- Prime and unique farmlands as designated by the SCS.

No Opportunity Areas

- Designated parks, recreation areas, or campgrounds.
- Hospitals, schools, churches, farmhouses, rural residences, or places of business.
- National Register listed historic or prehistoric sites.
- Private landing strip-restricted areas as defined by the FAA.
- Radio, television, or microwave tower sites.

TABLE 2-6

Route Selection Objectives

- Maximize use of rangeland and uncultivated areas in cropland.
- Maximize use of existing rights-of-way or parallel construction when system reliability is not jeopardized, costs are not substantially increased, and adjacent land uses are compatible.
- Avoid farmsteads and occupied dwellings.
- Avoid incompatible obstacles or systems, such as landing strips, oil wells, or communication systems, that would result in interference.
- Avoid identified recreational, historical, archaeological, paleontological, or other culturally significant areas.
- Avoid disturbance of endangered wildlife species.
- Minimize effects on existing irrigation systems.
- Minimize disturbance of prime and unique farmlands.
- Minimize disturbance of cultivated croplands.
- Minimize conflicts with existing and planned urban land uses, including residential, commercial, and industrial areas.
- Minimize visibility of line from area highways.
- Minimize possible destruction of riparian areas, wetlands, and other areas of conservation and ecologic importance.
- Minimize siltation of aquatic systems.
- Minimize length of line located in floodplains.
- Minimize crossing potentially unstable or highly erosive soils.
- Minimize interference with extraction of economic minerals.
- Minimize circuitous routing that would increase costs and could increase overall impacts.
- Minimize engineering, construction, and maintenance hazards.
- Enhance electrical reliability of the transmission system.

they were given the same rank and the subsequent rankings continued sequentially. For example, if two routes tied for first, they were both given a rank of 1 and the third route was given a rank of 2. Table A-3 shows the rank order (in parentheses) for each route for each environmental factor.

The next step was to add all ranks for each of the 33 environmental factors for each of the 12 routes being evaluated (i.e., add by row on Table A-3). The results of this addition are presented below.

	Total of Ranks	Rank Order of Routes
Route A	153	(8)
Route B	126	(4)
Route C	159	(9)
Route D	164	(10)
Route E	153	(8)
Route F	135	(6)
Route G	131	(5)
Route H	110	(2)
Route I	111	(3)
Route J	147	(7)
Route K	107	(1)
Route L	135	(6)

Since 1 was always assigned for the highest consistency with an objective, the route with the lowest total score would be given a final rank order of 1. As can be seen above, Route K had the lowest score and was given a final rank order of 1.

As the final step in the route evaluation process, Western evaluated the 12 routes based on consistency with management objectives, economics, design and construction parameters, access to the Thermopolis Substation, and compatibility with future plans to energize the line at 230-kV. Western selected Route L as the proposed route for the Carter Mountain to Thermopolis Transmission Line Project.

The second public meeting was conducted at this point in the process on September 12, 1990 in Thermopolis, Wyoming. Western's proposed route was presented and compared to Western's existing 69-kV route. Comments were received regarding construction workforce requirements, wildlife concerns, safety, and system operation.

2.5 Comparison of Impacts of Western's Proposed Route and Alternatives

As described in Section 2.4, Western evaluated 12 routes. Based on a comparison of environmental factors in Appendix A, Table A-2, and considering design, construction, and future compatibility, the 12 routes were narrowed down to three primary alternative routes. Table 2-7 presents a comparison of Western's proposed route (Route L) and two alternative routes, including Western's existing 69-kV transmission line ROW (Route A) and the final rank order 1 route (Route K).

Route L, Western's proposed route, would have no significant impacts based on the significance criteria and impact analysis presented in Chapter 4. However, Route L would have certain impacts, both beneficial and adverse that should be highlighted. Route L would be approximately 41.5 miles long, compared to 40.4 miles for the shortest and 44.1 miles for the longest. Routes L, A, and K would all be about the same length. Approximately 98 percent of Route L (40.5 miles) would cross rangeland, compared to approximately 95 percent (39.5 miles) for Route A and approximately 98 percent (40.5 miles) for Route K. Route L would cross 0.1 mile of prime farmland; Route A, 1.0 mile; and Route K, 0.1 mile. Approximately 74 percent (30.8 miles) of Route L would cross federal and state lands, compared to 51 percent (21.3 miles) for Route A and 76 percent (31.5 miles) for Route K. There would be one occupied residence within 0.25 mile of the proposed route. There would be 7 and 0 occupied residences within 0.25 mile of Route A and Route K, respectively.

Approximately 97 percent (40.1 miles) of Route L would be parallel to existing transmission lines. Approximately 40 percent (16.5 miles) of Route A and approximately 88 percent (36.3 miles) of Route K would be parallel to existing transmission lines. Route L would require 5.0 miles of new access roads; 3 crossovers of other lines; and 24 special structures. Special structures include small angle, medium angle, heavy angle, and dead end transmission line structures. Route A would require 0.3 mile of new access roads, 3 cross-overs, and 21 special structures; while Route K would require 3.8 miles of new access road, 4 cross-overs, and 17 special structures. Please refer to Table A-3 (Appendix A) for detailed quantification of Route L for each environmental factor and for comparison to the other eleven routes evaluated.

The environmental differences among alternative routes are, for the most part, minor. The environmental factors most responsible for the different rankings of Routes L and K deal with moderate and excessive slopes. Slope is a general measure of the potential for soil erosion. Western recognizes this potential and intends to implement construction and mitigation procedures that will limit or prevent soil erosion. Therefore, from an environmental perspective, Western views Routes L and K as being very comparable. The better entry into

TABLE 2-7

Comparison of Proposed and Alternative Routes for the Carter Mountain-Thermopolis Transmission Line Project

Environmental Inventory Factor	Western's Proposed Route (Route L)	Western's Existing 69-kV Transmission Line ROW (Route A)	Final Rank Order (1) Route (Route K)
Total line length (miles)	41.5	41.5	41.4
Parallel to existing lines (miles)	40.1	16.5	36.3
Existing road access (miles)	27.5	37.9	22.6
Private land crossed (miles)	10.6	20.2	9.9
Residences within 0.25 mile (#)	1.0	7.0	0.0
Cropland crossed (miles)	0.3	1.2	0.2
Prime farmland crossed (miles)	0.1	1.0	0.1
Floodplains crossed (miles)	1.8	3.1	1.8
Riparian/wetland areas crossed (miles)	0.7	0.9	0.7
Sage grouse production areas crossed (miles)	9.4	14.7	10.3
Crucial winter range crossed (miles)	24.8	23.9	25.0
Improved wildlife ponds crossed (#)	4.0	8.0	6.0
Historic features crossed (#)	4.0	7.0	5.0
Sensitive scenic areas crossed (miles)	3.4	4.7	3.3
Moderate slopes crossed (miles)	2.1	1.7	1.6
Excessive slopes crossed (miles)	1.0	0.5	0.9

the Thermopolis Substation of Route L caused Western to select this route as its Proposed Action.

3.0 AFFECTED ENVIRONMENT

3.1 Climate and Air Quality

The climate of the study area may be characterized as semi-arid continental. The region between Thermopolis and Meeteetse is in the foothills of the Absaroka Range of the Rocky Mountains, which run northwest to southeast some 20 miles to the southwest of the study area. The study area is located in a region of hills and mountains with moderately rough to rough terrain. Climatic characteristics for the project area are described below (NOAA 1974).

The mean annual temperature at Thermopolis is 47F. Monthly average temperatures at Thermopolis range from 72F in July to 21F in January. The maximum temperature ever recorded at Thermopolis was 107F, and the record minimum is -44F. Temperatures in the study area could be expected to vary somewhat from those at Thermopolis since most of the study area is in elevated terrain relative to Thermopolis, which is located at the lower end of the Wind River Canyon along the banks of the Bighorn River. The higher terrain within the majority of the study area is expected to generally produce slightly cooler average temperatures and more moderate temperature extremes relative to the Thermopolis data.

Precipitation in northwest Wyoming is primarily a result of Pacific Ocean and orographic influences. The major source of moisture is frequent influxes associated with weather systems from the Pacific Ocean and Canada. Maximum precipitation occurs during the spring with the driest months being during the winter. Mean annual precipitation in Thermopolis is 11.52 inches of water equivalent moisture. Average growing season length is 118 days in Thermopolis.

Severe weather in the region can include periods of heavy snowfall accompanied by strong winds and blowing and drifting snow resulting in blizzard conditions. Springtime and summer bring severe thunderstorms accompanied by brief periods of heavy downpours, hail, lightning, and strong gusty winds. Although not as frequent as parts of Wyoming further to the east, severe thunderstorms in this region will occasionally spawn small short-lived tornadoes. In the spring and fall, the region can experience freezing rain accompanied by strong winds, resulting in icing of trees and overhead lines; however, these are rare events.

Visibility in the region is excellent with median yearly visual range of approximately 70 miles. Air quality in the region is very good. The region through which the transmission line would pass is rural. With the exception of small local population centers, there are no known significant sources of air emissions. Particulate data from Thermopolis, the only urban community in the study area, reflect the clean nature of local air quality. Data collected at Thermopolis from July

1976 through March 1978 show a maximum 24-hour Total Suspended Particulate (TSP) concentration of 58 micrograms per cubic meter ($\mu g/m^3$), well below the Wyoming TSP standard of 150 ($\mu g/m^3$). There are no gaseous pollutant data available for the region; however, no significant levels are believed to exist. Pollutant levels in rural undeveloped areas are generally lower than those found in urban settings such as Thermopolis.

3.2 Paleontology, Geology, and Soils

3.2.1 Paleontology

The BLM paleontological resources map for the Grass Creek Resource Area (GCRA) indicates that no protected paleontological resources have been documented in the study area. Although no resource sites have been identified, four geologic formations occurring in the study area have been recognized by the BLM as fossil bearing. They include the Cretaceous Lance Formation and the Tertiary Fort Union, Willwood, and Tatman Formations. BLM's records indicate that the following fossils may be found within these formations: Lance - dinosaur bones are common; Fort Union - casts of fossil leaves and plants are often common; Willwood - fossil remains of mammals and fresh water life are abundant; and Tatman - a fossiliferous limestone member that contains abundant snails and clams (BLM 1976). Continuing research and field studies are being conducted within the Bighorn Basin by a variety of university teams and scientists for identification of important paleontological resources (Bies 1991). Under federal legislation, only vertebrate fossils found on federal land are protected against collection and destruction.

3.2.2 Geology

The study area is located on the southwestern "basin shoulder" of the Bighorn Basin in northcentral Wyoming. The "shoulder" is a platform of anticlines and synclines that encircles the basin. It is between 5 and 10 miles wide and forms a bench between the mountains to the outside and the low, flat, and dry center of the basin to the inside (Lageson and Spearing 1988). Vertical displacement during the Laramie orogeny created a zone of faults that produced the shoulder. It contains many asymmetric anticlines, some of which contain oil. Oil fields in this area include Hamilton Dome, Grass Creek, and Little Buffalo Basin.

Both the Western 69-kV and the Tri-State 115-kV existing lines generally follow Wyoming State Highway 120, which runs along the eastern margin of the "basin shoulder." Numerous anticlines and synclines, consisting of folded Mesozoic strata, lie west of the highway. The east dipping Paleocence Fort Union and flat-lying Eocene Willwood formations crop out to the east. The Fort Union contains high cliffs of brown to gray sandstone as well as gray to black shale and thin beds of coal. The Willwood is distinguished by its brightly variegated claystones and

sandstones, with some lenses of quartzite conglomerate. Both the Fort Union and Willwood are river deposits laid down after the retreat of the Cretaceous marine seaway.

To the east between Wyoming State Highway 431 and Meeteetse, the Eocene Tatman Formation overlies the Willwood and consists of drab claystone and sandstone, with some oil shale and lignite coal. Also found in this area are the Squaw Teats which form two prominent peaks east of State Highway 120. They are erosional remnants of the Eocene Tepee Trail Formation, an olive-drab andesitic conglomerate. The existing PP&L 230-kV line crosses the Tatman Formation in this area. Near Thermopolis, the highway follows the southwest limb of the Thermopolis anticline and passes steeply dipping outcrops of the Cody, Frontier, Cloverly, Morrison, Sundance, and bright-red Chugwater Formations northeast of the highway (Lageson and Spearing 1988). The more resistant sandstone layers form pinyon-covered ridges or hogbacks.

No geologic hazards were observed during a reconnaissance of the study area, although many areas of steep slopes (erosion hazard) were noted. No areas of slumping, subsidence, or unstable soils were observed. The Geological Survey of Wyoming (GSW) has produced a preliminary map of liquefaction-prone areas (saturated alluvial deposits) in western Wyoming. The narrow bottomland of Owl Creek northwest of Thermopolis is included as liquefaction-prone (Case 1986). During liquefaction, materials composed primarily of water-saturated sands and silts lose their strength and behave as viscous fluids. The liquefaction hazard may be increased during spring runoff, during years of increased precipitation, in areas of extensive irrigation, and in or around seismically active areas.

The same GSW report also notes that the Thermopolis area has experienced approximately 8 earthquakes of intensity IV or greater within a 25-mile radius since 1928 (Case 1986). Most of the quakes caused no more damage than the rattling of dishes. The largest quake occurred in 1972. It was of intensity V and magnitude 4.1. The only reported damage was a cracked ceiling at a rest home in Thermopolis (Case 1986).

3.2.3 Soils

Soil surveys have been completed for the entire study area. BLM contracted Soil and Land Use Technology, Inc. (SaLut) to conduct an Order III soil survey of the Grass Creek area in 1978 (SaLut 1979). The Soil Conservation Service (SCS) has conducted detailed surveys of private lands, most often along drainageway bottomlands, within the BLM Grass Creek Resource Area (GCRA). These surveys include areas along Owl, Cottonwood, Grass, and Gooseberry Creeks which are crossed by the various alternative transmission line links. This soil survey information is currently unpublished but has been made available for this project (SCS 1989).

Soils between Thermopolis and Owl Creek are dominantly Ustic Torriorthents. These soils are shallow to deep, well drained, reddish loamy soils formed in alluvium and material weathered from sandstone. Areas of sandstone and shale bedrock are common. The Owl Creek bottomland, including Spring Draw, contains Ustic Torriorthents and Ustic Torrifluvents. These soils are very deep, well and moderately well drained, moderately to strongly alkaline, brownish loamy soils formed in alluvium. These soils are also found on Grass Creek and Gooseberry Creek bottomlands further to the northwest.

Soils between Owl Creek and Cottonwood Creek are dominantly shallow to deep Ustic Torriorthents and Ustollic Haplargids found on fans and uplands. These are brownish loamy soils formed in alluvium and material weathered from interbedded sandstone and shale. The center portion of this area, around the Sand Draw area, contains shallow Ustic Torriorthents and rock outcrop. These shallow, well drained, brownish clayey soils formed in material weathered from gypsiferous shale. Bedrock is interbedded sandstone and shale.

Soils along Cottonwood Creek consist of very deep Ustollic Haplargids and Ustic Torriorthents. These are well drained, nearly level, brownish gravelly and loamy soils formed in alluvium or terraces and fans. The remainder of the soils along the alternative links are shallow to deep Ustic Torriorthents and Ustollic Haplargids. These soils are well drained, brownish loamy soils formed in alluvium and material weathered from interbedded sandstone and shale on uplands and fans.

Two soils in Hot Springs County have been classified by SCS as "prime farmland if irrigated" (SCS 1989). These are the Kishona soil in map units KSA and KSB, and the Neville soil in map units NEA and NEB.

3.3 Water Resources

The study area lies in the Bighorn River Basin within the larger Missouri River Basin (Peterson 1988). Four perennial streams that cross the project area include Owl, Cottonwood, Grass, and Gooseberry Creeks, which originate within the Absaroka Mountains. These streams flow east from the Absarokas rapidly dropping in elevation into the Bighorn Basin and meander through semi-arid rangeland until reaching the Bighorn River, a major tributary of the Yellowstone River system (BLM 1981). Grass Creek, however, flows directly into Cottonwood Creek before reaching the river. Numerous ephemeral or intermittent drainages are also present throughout the region.

All of these streams exhibit wide seasonal and annual variations of discharges based on differences in climatic conditions and physical features (Lowham 1988). Hydrologic changes

within the Bighorn Basin have also occurred as a result of increased irrigation development and reservoir construction. These factors contribute to decreased historic flows within the streams and their tributaries.

The main source of perennial flow in the Bighorn Basin is from snowmelt in the mountains, with some additional ground water discharge (Lowry et al. 1976; Lowham 1988). Annual discharges substantially increase in May and generally peak in June regulated predominantly by snowmelt; however, this may vary year-to-year depending on local weather conditions and specific geographical features (Lowham 1988; Peterson 1988). Subsequently, streamflow may be sustained during fall and winter months by ground water discharge (BLM 1981).

Table 3-1 presents the values for the average mean flows recorded at four perennial water gaging stations in the study area; the maximum and minimum flows shown are typically due to year-to-year variation in precipitation. Intermittent and ephemeral flows are typically associated only with snowmelt and rainfall. These streams may receive some groundwater inflows in addition to direct surface runoff; however, these inflows are insufficient to sustain discharges throughout the year. Flows within these drainages are often separated by long periods of no flow (Lowry et al. 1976; Lowham 1988).

Four classes of streams are identified by the Wyoming Department of Environmental Quality's (WDEQ) Water Quality Regulations entitled "Quality Standards for Wyoming Surface Waters," (WDEQ 1983). All Wyoming waters are designated as belonging to one of the following four water quality classifications. The streams located in the project area are classified as either II or IV under the water quality standards (see Table 3-1).

Class I: Those surface waters which shall be maintained at their existing quality and in which no further water quality degradation by point source discharges will be allowed.

Class II: Those surface waters, other than those classified as Class I, which are determined by the Wyoming Game and Fish Department to be presently supporting game fish or have the hydrologic and natural water quality potential to support game fish.

Class III: Those surface waters, other than those classified as Class I, which are determined by the Wyoming Game and Fish Department to be presently supporting non-game fish or have the hydrologic and natural water quality potential to support non-game fish.

Class IV: Those surface waters, other than those classified as Class I, which are determined by the Wyoming Game and Fish Department not to have the hydrologic or natural water quality to support fish.

TABLE 3-1

Stream Characteristics

Stream Station	Stream Class[1]	Annual Mean Discharge Average (cfs)[2]	Annual Mean Discharge Range (cfs)	Maximum Instantaneous Discharge (cfs)
Owl Creek near Thermopolis (06264000)[3]	II	27.4	2.91 - 81.0	7,030
Cottonwood Creek at Winchester (06265500)	II	----	10.40 - 41.9	4,120
Gooseberry Creek near Grass Creek (06266000)	II	13.8	2.04 - 29.7	593
Gooseberry Creek at Dickie (06265800)	II	14.0	3.58 - 26.0	1,130
Grass Creek[4]	IV	----	----	----

Sources: Lowry et al. 1976; Peterson et al. 1987; Peterson 1988.

[1]Wagner 1991.

[2]Cubic feet per second.

[3]Identification number that is customarily used by the U.S. Geological Survey. Use of these four specific gaging stations has been discontinued.

[4]No U.S. Geological Survey gauging stations are located on Grass Creek.

In addition to the above water quality classifications, the Wyoming Game and Fish Department has developed classifications for fisheries, with an emphasis on trout waters. Fisheries classifications are presented in the aquatic resources section.

The predominant use of surface water in the Bighorn Basin is for irrigation because precipitation in the area is typically small and unpredictable (Lowry et al. 1976; Lowham 1988). Historically, the water quality in many of these water resources has been listed as poor, due to intense livestock grazing along these riparian areas (BLM 1982). Human activities have also accelerated natural erosion and increased surface water salinity in some areas. However, sedimentation from erosion is the most serious water quality problem found in the project area. Another factor of poor surface water quality stems from bacterial contamination from livestock grazing near these water sources (BLM 1982).

Owl Creek's gaging station near Thermopolis was active three periods from 1910 to 1969. Stream characteristics for this drainage are shown in Table 3-1. For the period of record, the maximum instantaneous discharge (7,030 cfs) occurred on June 15, 1963 (BLM 1981). Owl Creek meanders through fine grain alluvial sediments within the study area, exhibiting cut banks and depositional fans (BLM 1981); the channel contains high sediment loads due to bank erosion during high flows (Lowry et al. 1976). Owl Creek and its tributaries have also shown salinity problems primarily due to the natural erosion (BLM 1982).

The U.S. Geological Survey (USGS) gaging station located at the mouth of Cottonwood Creek at Winchester was operated from 1941 to 1945. Channel stability and streambed material vary along this stretch of the creek. Cottonwood Creek meanders through medium to fine grain alluviums, continually widening its flood plain (BLM 1981). Cottonwood Creek has exhibited salinity problems due to discharge from the nearby Hamilton Oil Field and the natural erosion of saline shale beds. The channel may carry large sediment loads in response to heavy rainstorms and high runoff conditions (BLM 1982; Lowry et al. 1976).

The Grass Creek drainage is a major tributary to Cottonwood Creek. No data on stream discharge were available; it is estimated, however, that the mean discharge is approximately 4 to 6 cfs. Spring and summer runoff account for most of the discharge, with fall and winter streamflows being low to possibly non-existent in some areas (BLM 1981). Channel stability is rated as fair to poor along this drainage, in addition to a bacterial problem due to heavy stock grazing (BLM 1982; BLM 1981).

Two USGS gaging stations were located along Gooseberry Creek; one operated from 1945 to 1957 near Grass Creek, and the second operated from 1957 to 1977 at Dickie (see Table 3-1).

Runoff into Gooseberry Creek peaks in June from snowmelt, with ground water and periodic thunderstorm activity sustaining the stream flow into July and August (BLM 1981). Gooseberry Creek meanders through sand and silt alluvium, with large cutbanks indicating channel erosion problems (BLM 1981). The stream experiences salinity problems due to natural erosion of saline shale beds (BLM 1982) and carries large sediment loads in response to heavy rainstorms (Lowry et al. 1976).

3.4 Floodplains and Wetlands

The study area is located in the Bighorn River Basin within the larger Missouri River Basin (Peterson 1988). The hydrology of the region is discussed in Section 3.3 of this report. Floodplains and/or wetlands are associated with the perennial streams found in the area. These sensitive areas were identified using high altitude aerial photography, low-altitude videotapes, and then subsequently examined during the field reconnaissance. Federal Emergency Management Agency (FEMA) flood hazard maps are not available for the project study area (FEMA 1991).

Floodplains are generally lowlands adjoining inland waters, which are typically flowing. The floodplains visibly identified along the perennial channels in the study area range from approximately 0.5 mile to 1.5 miles in width, with the largest floodplain occurring along Owl Creek in the southern portion of the study area. The basis for flood plain identification from the aerial photographs included measurement of level areas located adjacent to channels exhibiting actively growing vegetation.

Wetland areas are small and scattered along the riparian drainages. Intermittent streams, those flowing sufficiently long to support growth of riparian vegetation, contain at least ten times the amount of wetland habitat as do the perennial streams (BLM 1982). Many of these wetland areas have been historically decreasing in quality and size due to the increased grazing pressure occurring in the project area (BLM 1982).

All floodplains and wetlands, except for the floodplain located along Owl Creek, would be spanned by the proposed transmission line; detailed project engineering will be required to determine actual structure placement.

3.5 Vegetation

Vegetation within most of the GCRA is of the northern desert shrub life zone. Vegetation becomes more dense as elevation and precipitation increases to the west. Elevation within the study area varies from 4,000 to 6,000 feet with a 6 to 10-inch annual precipitation. Soils are generally of poor quality and plants have low density and small size (BLM 1976).

Eight vegetation types are found in the study area: 1) waste-barren (mostly badlands), 2) saltbush, 3) sagebrush, 4) grass, 5) juniper, 6) greasewood, 7) annuals, and 8) private cropland. The waste (badland) type has a very rough and broken land surface originating from soft, saline, clayey, shale bedrock. Nuttall saltbush and shadscale are characteristic plants. Halogeton can be found near the bases and crests of these badland hills.

The saltbush type is generally found in lower flat lying areas where the soils have impermeable layers due to soil clay compaction and high salinity. Plants include Nuttall saltbush, birdfoot sagewort, plains pricklypear, squirreltail, alkali sacaton, blue grama, red three-awn, and Sandberg bluegrass. On well drained sites, a few grasses such as western wheatgrass and Indian ricegrass remain. Due to heavy livestock use, plants such as plains pricklypear have replaced climax species.

Big sagebrush is the most common vegetation type. These communities appear stunted because of poor climatic and soil factors, although more plant species are present than in the saltbush type. The most common understory species are the perennial grasses such as blue grama, Sandberg bluegrass, western wheatgrass, Indian ricegrass, needle-and-thread, and junegrass. Pricklypear cactus, budsage, small rabbitbrush, and scarlet globemallow are also found.

The grassland type consists primarily of blue grama, Sandberg bluegrass, and western wheatgrass. Other grasses include squirreltail, Indian ricegrass, junegrass, needle-and-thread, bluebunch wheatgrass, and red three-awn. This type also includes big sage, plains pricklypear, and a few other perennials. This type has decreased in size due to overgrazing by livestock.

The Utah juniper vegetative type occurs in narrow bands along rim rock areas, ridge crests, and rocky talus slopes. The largest stands of juniper occur near the town of Thermopolis. The plant species associated with this type include many of the previously mentioned grasses plus big sagebrush, black sagebrush, small rabbitbrush, and skunkbrush.

The greasewood type is found on saline floodplains where the water table is near the surface. This type is very common along Cottonwood Creek, Gooseberry Creek, and similar drainages in the study area. Other plants in this type include alkali seepweed, silver saltbush, alkali cordgrass, alkali-grass, and saltgrass. Other drainages support wet meadow and marshy type vegetation. Parts of Gooseberry, Cottonwood, and Owl Creeks support this vegetation. Scattered areas of hayland can be found on drainageway bottomlands.

Annuals, mainly Russian thistle, cheatgrass, halogeton, pepperweed, and cockbur occur mainly in disturbed areas. Some poisonous and noxious plants can be found within the study area.

The major problem poisonous plant is larkspur. Other poisonous and noxious plants include locoweed, lupines, death camas, halogeton, arrowgrass, greasewood, Russian knapweed, and whitetop.

3.6 Wildlife

3.6.1 Nongame Species

The Carter Mountain-Thermopolis study area ranges from flat-lying areas at approximately 4,000 feet in elevation to rocky ridges and talus slopes up to 6,000 feet in elevation. Habitat types for area wildlife include saline bottoms and wet meadows, riparian drainages, agricultural fields, shrub steppe, prairie and foothill grasslands, foothill shrub and woodland, barren cliffs, and rocky outcrops.

Four perennial streams and one intermittent stream occur in the study area: Owl, Cottonwood, Grass, Gooseberry, and Buffalo Creeks, respectively. All of these drainages flow into the Bighorn River. As reported by the BLM, nearly 75 percent of the perennial stream miles and associated riparian vegetation on public lands are declining in overall stability and habitat quality for both fish and wildlife species. In many of the main drainage areas, grazing pressure has affected the riparian vegetation and led to associated problems, such as enlarged gullies and increased sedimentation (BLM 1982).

In addition to these creek drainages, numerous small reservoirs or stock ponds are used throughout the region. A few of these have been improved by the BLM for wildlife species, particularly waterfowl. Watering ponds and reservoirs recorded by the BLM were taken directly from the agency's resource maps (Denton 1989) and from color-infrared aerial photographs of the study area (USGS 1989). These water resources provide valuable wetland habitat for a variety of species. Wildlife populations using these resources are influenced by reservoir size, associated wetland vegetation, and the structural habitat diversity present (BLM 1982).

The vegetative community often determines what wildlife species inhabit an area. Some species use a number of habitats to fulfill basic requirements, whereas other species are largely restricted to a single habitat type. The proposed project area encompasses a variety of wildlife resources and habitats. Amphibian species that may be found along the area water resources include the plains spadefoot, tiger salamander, Great Plains toad, chorus frog, and northern leopard frog. Reptiles include the sagebrush lizard, racer, bullsnake or pine snake, western rattlesnake, plains garter snake, and milk snake (BLM 1981; USFWS 1987).

Bird species are numerous and diverse throughout the varied habitat types, with concentrations of individuals most apparent during migration periods and the breeding season. Nongame water birds that may be observed include species such as the eared grebe, great blue heron, American coot, American avocet, willet, greater and less yellowlegs, killdeer, and a variety of sandpipers (BLM 1981); the sandhill crane may also be observed migrating through the area (Denton 1989). Terrestrial birds would include the western meadowlark, mourning dove, northern flicker, barn swallow, and common nighthawk to mention a few (BLM 1981). A number of area raptor species that maintain active nest sites and are not state or federally listed or considered candidates for listing include the golden eagle, northern harrier, red-tailed hawk, prairie falcon, American kestrel, and great horned owl (Ritter 1989). The exact locations of these nesting areas reported by the Wyoming Game and Fish Department (WGFD) within the study area (Ritter 1989) will not be revealed to ensure protection of the nest sites and inhabitants. Other raptors that may reside yearlong, winter, or migrate through the project region include the rough-legged hawk, gyrfalcon, Cooper's hawk, sharp-shinned hawk, long-eared owl, and common barn owl (Denton 1989; USFWS 1987).

Common nongame mammals may include the masked shrew, California myotis, deer mouse, long-tailed vole, white-tailed prairie dog, thirteen lined ground squirrel, and northern pocket gopher (Luce 1989; BLM 1982; BLM 1981).

3.6.2 Game Species

Game animals occurring within the transmission line study area include a variety of bird and mammal species. Much of the area encompasses important big game habitat for both breeding and wintering animals. A portion of these areas delineated by the state and federal agencies are considered not only important but also crucial to some species' survival and reproduction.

Upland game birds include sage grouse, chukar, gray partridge, and ring-necked pheasant. Sage grouse are associated with sagebrush, grassland, and saltbush habitats (Denton 1989; BLM 1982). Although this species occurs throughout the project region, sage grouse populations have been declining due to loss of habitat, impacts to breeding or lek areas, and a decrease in preferred forage items (BLM 1986; BLM 1982). Sage grouse breeding occurs from mid-March to the end of April. Map 2-2 shows active lek areas or strutting grounds currently recorded within the study area; additional breeding sites may occur in other appropriate habitats. Brooding habitat for sage grouse hens is often associated within 2 miles of riparian areas (Denton 1989).

Chukars prefer rocky outcrops and areas containing cheatgrass brome and Sandberg's bluegrass. Chukars are found primarily east of Highway 120 with a few individuals known to occur along Owl Creek. Gray partridges occur near riparian, agricultural, and other upland areas and are considered widespread, but not abundant. A few ring-necked pheasants are predominantly associated with agricultural fields and riparian lands (Denton 1989; BLM 1986; BLM 1982).

Area creeks, tributaries, reservoirs, and smaller stock ponds provide habitat for a variety of both resident and migratory waterfowl. Species may include the Canada goose, northern pintail, gadwall, green-winged teal, mallard, and American wigeon to mention a few (BLM 1986; BLM 1982). As discussed in Section 3.6.1, a number of small reservoirs or ponds scattered throughout the project area are used by many wildlife species, particularly waterfowl (Denton 1989).

Abundant game mammals occur within the project region. Important fur bearers include beaver, muskrat, mink, raccoon, badger, and bobcat (BLM 1986). Both mule deer and white-tailed deer inhabit the study area, with mule deer being the most abundant big game species. Individual mule deer maintain daily movement patterns, based on forage availability, while the population exhibits seasonal migrations between summer areas and crucial wintering range (Denton 1989; WGFD 1989a, Hurley 1989, BLM 1982). White-tailed deer sustain a more cyclic population than mule deer. Non-migratory white-tailed deer primarily inhabit some of the larger creek bottoms, particularly along Owl Creek.

Pronghorn are yearlong residents in the area and utilize crucial winter range as well as spring fawning areas (Hurley 1989; Denton 1989; WGFD 1989a). Crucial wintering areas are prominent within the entire project area. Spring fawning locations are interspersed throughout. Important migrational routes also exist primarily between Grass and Cottonwood Creeks and above Gooseberry Creek, continuing north of the Carter Mountain Substation. Migrational areas have been decreasing in size due to increased fencing and development occurring north of the project area. Timing of migrational periods is dependent upon weather patterns and environmental conditions (e.g., snow depth), with spring migration varying to a greater extent than the fall period (Denton 1989).

3.6.3 Aquatic Resources

Major aquatic resources to be examined encompass the four perennial and one intermittent drainages crossed by the study area. Owl, Cottonwood, Grass, and Gooseberry Creeks comprise the perennial streams originating in the Absaroka Mountain Range and flowing into the Bighorn River. Buffalo Creek is classified as intermittent. Each stream's discharge varies seasonally and from associated water diversion activities.

As discussed in Section 3.6.1, approximately 75 percent of the perennial stream channels and their associated riparian vegetation located on public lands are declining in overall stability and habitat quality for both fish and wildlife species. In many of the primary watersheds, livestock grazing has impacted the riparian vegetation and has led to associated problems, such as increased soil erosion and subsequent water quality degradation by channel sedimentation (BLM 1982).

Native fish species that occur in the streams located in the study area include both game and nongame or forage fish species. Fish densities and species' compositions would vary between each of the creeks and their tributaries within the project area depending on the relevant water quality, seasonal discharge, and the specific location of the proposed line crossing and how that stream segment may be affected by other water requirements such as agricultural activities (McKnight 1990).

General nongame species for all of the perennial drainages would include the white sucker, fathead minnow, flathead chub, lake chub, mountain sucker, longnose dace, and plains killifish (McKnight 1990; Baxter and Simon 1970). Buffalo Creek may periodically contain a smaller number of nongame species than that of the larger streams.

Streams within the project area have been classified by the Wyoming Game and Fish Department as to the quality of the fishery that exists according to the following system (WGFD 1987).

- Class I - Premium trout waters - fisheries of national importance.
- Class 2 - Very good trout waters - fisheries of statewide importance.
- Class 3 - Important trout waters - fisheries of regional importance.
- Class 4 - Low production trout waters - fisheries of local importance, incapable of sustaining substantial fishing pressure.
- Class 5 - Very low production waters - often incapable of sustaining a trout fishery.

Trout fisheries for these streams are predominantly restricted to upstream reaches, while nongame species primarily occupy the middle and downstream areas. The absence of fish in some of the stream segments can be attributed to low flows. In addition, the lack of spawning areas and habitat cover in Owl Creek and Cottonwood Creek limit the trout populations

(BLM 1982). Although these conditions exist within the perennial drainages, trout species may occur within the lower reaches under the appropriate conditions (McKnight 1990).

Owl Creek is classified as a Class 4 stream. Although the stream supports marginal brown and rainbow trout fisheries, portions of the drainage may not fall within this specific stream classification (McKnight 1990; BLM 1981). Overall, Owl Creek would be considered an important local fishery.

Cottonwood Creek is classified as a Class 4 stream with Yellowstone cutthroat, rainbow, brown, and brook trout occurring primarily in the upper reaches of the drainage (BLM 1981). However, these species may be found in the lower areas of the project region during periods of high water (McKnight 1990).

Grass Creek is classified as Class 3. This would apply more for the upper reaches of the drainage where wild brook and stocked rainbow trout occur (McKnight 1990; BLM 1981). Occasional individuals may be found within the lower reaches of the stream in the study area (McKnight 1990).

Gooseberry Creek is classified as Class 4. This stream supports small populations of both brown and brook trout (McKnight 1990; WGFD 1989c); however, it is not anticipated that these species would typically be numerous in the area of the proposed line crossings and would likely only occur during periods of high water (McKnight 1990).

Buffalo Creek is classified as Class 4 (WGFD 1987). No trout species would likely occur in this area due to the limited amount of appropriate habitat available during most of the year (McKnight 1990).

Existing stream habitats in the project area are characterized by the decreasing amount of riparian bank cover, scouring of the channel bottom, bank erosion, and increased sedimentation. Distinct examples occur along both Owl and Cottonwood Creeks, where damaged stream banks wash away during annual high flows, consequently widening the channels, decreasing water depth, and contributing to the loss of spawning areas, thereby reducing the capabilities of these drainages to support viable trout populations.

3.7 Sensitive Species

3.7.1 Wildlife

Occurrence data for all sensitive wildlife species were requested from the appropriate state and federal agencies, for both historical and current range information. Three federally listed endangered species may potentially occur within the project area; these include the bald eagle, peregrine falcon, and black-footed ferret (USFWS 1989a). In addition to these three species, six federal candidate species and one other state priority species inhabit various areas associated with the proposed project (Denton 1989; Luce 1989; WGFD 1989b; USFWS 1989a). Species in need of special management would be classified by the WGFD as priority species (Luce 1989). Table 3-2 lists all sensitive wildlife species to be examined for the proposed project.

A Biological Assessment that addresses the bald eagle, peregrine falcon, and black-footed ferret has been prepared for submittal to the U.S. Fish and Wildlife Service (USFWS). The USFWS identified these three listed species for detailed analysis in compliance with Section 7(a)(2) of the Endangered Species Act of 1973, as amended. This assessment is presented in Appendix A of this document.

The bald eagle (Haliaeetus leucocephalus) is primarily a winter resident along the Bighorn River, an area listed as crucial eagle wintering habitat by the WGFD. Individuals may move west into the study area to forage, particularly within mule deer winter range and during cyclic highs in cottontail rabbit populations (Ritter 1989; Denton 1989). No historical or communal roost sights are known to occur along the riparian drainages located in the project area (Ritter 1989); although, feeding areas, night roosts, and diurnal perches may be used during migration and wintering periods. No bald eagle nesting has been documented near the proposed project (Denton 1989).

The peregrine falcon (Falco peregrinus) would be considered a rare migrant through the area (Ritter 1989). Although no nesting has been recorded by the state and federal agencies, potential peregrine habitat exists along the rocky outcrops and cliff areas located throughout the study area (Denton 1989). Habitat classified by the WGFD as crucial peregrine recovery habitat occurs within the canyons located outside of the project area immediately south of Thermopolis (WGFD 1989b).

The black-footed ferret (Mustela nigripes) historically occurred within the project region. Ferrets rely on prairie dogs as their primary food source and are generally associated with prairie dog colonies. White-tailed prairie dogs are common in the project area and may inhabit colony

TABLE 3-2

Sensitive Wildlife Species
Potentially Occurring within the Study Area

Common Name	Scientific Name	Status[1] Federal	State
Bald eagle	(Haliaeetus leucocephalus)	E	E
Peregrine falcon	(Falco peregrinus)	E	E
Black-footed ferret	(Mustela nigripes)	E	E
Ferruginous hawk	(Buteo regalis)	C-2	P-III
Swainson's hawk	(Buteo swainsoni)	C-3C	---
Long-billed curlew	(Numenius americanus)	C-2	P-III
Mountain plover	(Charadrius montanus)	C-2	---
Spotted bat	(Euderma maculatum)	C-2	P-III
Allen's thirteen-lined ground squirrel	(Spermophilus tridecemlineatus alleni)	C-2	---
Burrowing owl	(Athene cunicularia)	---	P-II

Source: USFWS 1989b, USFWS 1989c, WGFD 1989b.

[1] E = Endangered. A species that is in danger of extinction throughout all or a significant portion of its range.

C-2 = Federal candidate species - category 2. Threat and/or distribution data are insufficient to support federal listing at this time.

C-3C = Federal candidate species - category 3C. Taxon that was once being considered for federal listing, but is not currently receiving such consideration. More abundant and/or widespread than previously thought.

P = State priority species. State classification of I, II and III, according to the species' vulnerability to extirpation or significant population declines in Wyoming.

complexes over 200 acres in size (Luce 1989). Therefore, there is a potential for black-footed ferrets to exist within the appropriate habitat.

The ferruginous hawk (Buteo regalis) is a federal candidate species category 2 and listed as a state Priority III species (USFWS 1989c; WGFD 1989b). Four active ferruginous hawk nests occur within the study area; three of those appear to be located along riparian habitat (Ritter 1989). The Swainson's hawk (Buteo swainsoni) is a federal candidate category 3c species (USFWS 1989c) and occurs in the study area but it not commonly seen (Ritter 1989; Denton 1989). No active nest sites have been currently recorded by the WGFD (Ritter 1989). The burrowing owl (Athene cunicularia) is listed as a state Priority II species and actively nests throughout the study area (Ritter 1989; WGFD 1989b). Prairie dog colonies may be considered as crucial nesting habitat for this species (Ritter 1989).

The long-billed curlew (Numenius americanus) is a federal candidate category 2 and classified as a state Priority III species (USFWS 1989c; WGFD 1989b), based on indications elsewhere in the state that the population is declining (Ritter 1989). Individual nesting sites may occur within the appropriate habitat types, but these areas have not been intensively surveyed (Denton 1989). The mountain plover (Charadrius montanus) is a federal candidate category 2 species (USFWS 1989c) and may maintain individual nest sites throughout the project region (Ritter 1989).

The spotted bat (Euderma maculatum) is a federal candidate category 2 and state Priority III species (USFWS 1989c; WGFD 1989b). Two specimens were recorded in the northern part of the Bighorn Basin, but population estimates within the entire western region is lacking; no other occurrences are known near the proposed project (Luce 1989; Long 1965). This species is associated with a variety of habitat types, including cliff areas and old buildings from low deserts to high conifer areas. It is also known to frequent perennial water sources (Luce 1989; BLM 1974).

Allen's thirteen-lined ground squirrel (Spermophilus tridecemlineatus alleni), a federal candidate - category 2, is a subspecies whose distribution is not well documented; although, the animal has been reported within the study area (Luce 1989; Long 1965). Few individuals have been verified within its historical range in western Wyoming, and the species has been considered possibly extirpated within the state (Long 1965).

The Fifteen-mile Wild Horse Herd, protected under the Wild and Free Roaming Horse and Burro Act of 1971, is located primarily along the Fifteen-mile drainage northeast of the Carter Mountain Substation site. The herd numbers approximately 200 animals (Denton 1989); however, the extent of the herd's range does not intersect with the study area.

3.7.2 Vegetation

No federally or state-listed threatened or endangered plant species are known to occur within the study area (Rocky Mountain Heritage Task Force 1989). Cymopterus evertii (Evert's Waferparsnip), a plant designated by the Wyoming Natural Diversity Database as a species of special concern, has been observed in several locations about 2 miles east of the existing Carter Mountain Substation. This plant has a ranking of G3 S3 which indicates that there are between 21 and 100 occurrences both on a worldwide and a statewide basis. It has been found under and among Limber pine in sandy soils on southwest-facing sandstone slopes. All available Wyoming Natural Diversity Database (WNDD) information on this plant has been obtained from The Nature Conservancy, Laramie, Wyoming (Rocky Mountain Heritage Task Force 1989). The area directly west of Highway 120 is currently being surveyed by The Nature Conservancy for plant species of special concern. These studies will be completed in 1993.

3.8 Land Uses, Plans and Zoning

The study area is located in Hot Springs County, Wyoming, extending from Thermopolis northwesterly to about 9 miles southeast of Meeteetse. A substantial majority of study area lands are publicly owned, mainly by the federal government under BLM management. The State of Wyoming owns sections 16 and 36 in each township crossed by the study area. Private lands are largely limited to narrow strips straddling easterly flowing streams. Larger assemblages of private land include a 2 to 3-mile wide strip where Cottonwood Creek crosses the study area and the area from Thermopolis to Owl Creek, northwesterly to Padlock Rim.

Grazing is the dominant use of area lands. Essentially all public lands are included in grazing allotments. Three-fourths of the allotted grazing is for cattle with the remainder devoted to sheep and domestic horses (BLM 1982). Agricultural cultivation in the study area is minimal, almost entirely limited to flood irrigated hay production. There are small cultivated areas on Gooseberry Creek near Hillberry Rim and along Cottonwood Creek. There is a substantial area of cultivated land along Owl Creek west of Highway 120, but most of the area is outside the study area.

The BLM plans to continue grazing activity in the study area based on a multiple-use strategy. Most allotments in the study area are rated in the maintenance ("M") resource management category. A few small areas fall in the custodial ("C") category and portions, mainly in the northwest end of the corridor, are rated for improvement ("I") (BLM 1982).

Hot Springs County has scenic protection restrictions in the vicinity of Round Top Mountain but no other zoning or land use regulations that would be germane to the proposed project. The State of Wyoming has established a goal "to minimize conflicts among utility corridor needs,

competing land uses, and local land use plans" (Wyoming Land Use Commission 1979). Related policies call for review and comment on utility corridor proposals by local, state, and regional jurisdictions; compatibility with existing environmental, economic, and land use conditions; and compliance with the spirit of the National Environmental Policy Act (NEPA).

3.9 Recreation

Formal recreation opportunities in the study area are limited to municipal and private facilities in the town of Thermopolis. Hot Springs State Park is just outside the study area in Thermopolis. Outside Thermopolis, most recreation in the study area involves local resident hunting, fishing, off-road vehicle (ORV) use and "general leisure" pursuits such as hiking, rock hounding, and a variety of sight-seeing activities (BLM 1982). These types of dispersed recreation activities are dependent on the character of the landscape with the quality of the experience taking precedence over the number of visitor days of use (BLM 1982).

Travelers on Highway 120 bound for Yellowstone Park or other major attractions "use" the study area for its scenic value and for other short-term, transient activities (BLM 1982). Approximately 325,000 vehicles travel Highway 120 annually.

3.10 Visual Resources

The BLM has implemented a visual inventory and analysis process to provide a systematic interdisciplinary approach to the management of aesthetic values on public lands. The Visual Resource Management (VRM) system inventories existing scenic quality and assigns visual resource inventory (VRI) categories based on a combination of scenic values, visual sensitivity, and viewing distance zones. Four visual resource classes have been established to serve two purposes: 1) as an inventory tool portraying relative value of existing visual resources, and 2) as a management tool portraying visual management objectives. Management objectives for each of the visual resource classes are listed in Table 3-3.

Much of the project area is rated VRM Class III. Some lands are rated Class II near Thermopolis and at the extreme northeast edge of the project area. There are also a few Class IV areas, mainly in the northern end of the area.

VRM class ratings in the project area are notably influenced by high viewer sensitivity and visibility rather than by especially high quality scenery. The scenic quality of the project area is predominantly Class C, the lowest of the three classes defined in the VRM system. The Owl Creek valley and Thermopolis area are rated Class B along with two small areas at the northwest

TABLE 3-3

Visual Resource Management Classes

Class I Objective:	The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
Class II Objective:	The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
Class III Objective:	The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
Class IV Objective:	The objective of this class is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.
Rehabilitation Areas:	Areas in need of rehabilitation from a visual standpoint should be flagged during the inventory process. The level of rehabilitation will be determined through the resource management planning (RMP) process by assigning the VRM class approved for that particular area.

Source: BLM Manual 8411.

end of the area. Only a very small area at the northeast edge of the project area is rated Class A for scenic quality by the BLM.

The landscape in the project area is predominantly broad sage/grassland valleys with rolling irregular bottoms defined by a series of northwest-southeast trending ridges. In places, the ridges have a badlands character with steep, barren slopes. The northwest quarter of the area is more rugged with greater terrain variation and pockets of grotto-like rock outcrops. Topography near Thermopolis is also somewhat more irregular punctuated by the truncated cone of Round Top Mountain.

Colors in the project area are predominantly tans, beiges, and browns in the winter. Rock outcrops to the north are whiter, chalky grey beige with patches of dark green pinyon and juniper. The hills north of Thermopolis have a strong red-orange cast in places. Distant mountain ranges are snow-capped much of the year, emphasizing the muted character of project area hues. Spring colors in the area are the grey-greens of dryland grasses and sages over much of the rangeland, phasing gradually through the summer into winter browns. Irrigated valleys and natural creek bottoms are brighter greens and occasional patches of pinyon or juniper are dark greens and olives.

Vegetation is limited to short grasses and low growing sage over most of the project area. There are stands of willow and cottonwood along stream bottoms and isolated groves of juniper and pinyon, mainly in upland areas. Residential neighborhoods in Thermopolis have more diverse mixtures of exotic trees and shrubs.

Man-made structural features, known as cultural modifications, are uncommon in the project area except in and near Thermopolis. Elsewhere the three existing transmission lines and associated substations (see Map 2-2) are the most visually prominent man-made features. There are also a few small oil fields with pump and tank structures as well as occasional fence lines and local service phone and electric lines.

Visual sensitivity is a function of numbers of viewers, duration of views, purpose for being in a position to view the landscape and distance between viewers and the landscape feature. High sensitivity areas in the project area include viewsheds from Thermopolis and Highways 120 and 431. Thermopolis is a residential population center and a tourist recreation stopping place. Approximately 3,000 people reside in Thermopolis and 800,000 visit Hot Springs State Park annually, mainly in the summer months (Thermopolis 1989). Highway 120 is a major recreation travel route for Yellowstone National Park carrying as many as 1,600 vehicles per day in peak summer months. Highway 431 is a significant feeder route for Highway 120 with peak period traffic of 250 vehicles per day (Wyoming Department of Highways 1988). Highway 431 is a short cut for traffic between Yellowstone and the Black Hills area of South Dakota.

The VRM Class II areas in the project area are generally in the foreground-middleground viewshed of high sensitivity viewpoints with Class A or B scenic quality. Where scenic quality rates Class C with similar sensitivity and relative distance, the management class drops to VRM Class III. VRM Class IV areas are either seldom seen or visible only from less sensitive viewpoints.

3.11 Cultural Resources

The project is located in the southwest portion of the Big Horn Basin. Human history of the basin dates to at least 11,000 years ago. Archaeological investigations have shown that the initial occupants of the basin hunted now extinct forms of animals such as mammoth and long-horned bison. Other archaeological investigations had shown that subsequent peoples living in the basin practiced a more generalized hunting and gathering economy (Frison 1978). Prehistoric site types that have been recorded in the project area include: lithic scatters (some with fire cracked-rock and ground stone), campsites, stone circles with and without lithic scatters, rock shelters (sometimes associated with petroglyphs and pictographs), lithic procurement areas, and isolated finds.

Historic development in the project area is documented from the 1740s, although major non-aboriginal use of the Big Horn River Valley did not begin until the early 1800s (Larson 1984). Important themes for the historical development of the project area include: Exploration and Fur Trade, Anglo-American Immigration, U.S. Army Exploration, Anglo and Aboriginal Conflict (Indian Wars), Ranching and Settlement, and Energy Extraction and Production. Historic site types recorded in the project area include: homesteads, mines, ditches, refuse scatters, isolated cairns, bridges, and historic transportation corridors.

A Class I Overview of the project area was undertaken as part of this environmental assessment. The overview was based on information on file with the Wyoming State Historic Preservation Office (SHPO). Although the Worland District Office of the BLM was consulted, the information duplicated that found in the Wyoming SHPO's office and was not used in compiling the overview. The study area defined for the Class I Overview was a 1-mile wide corridor centered on existing powerlines and alternative links. Occasionally, the study area would be expanded by a half mile to include several powerlines paralleling each other.

A total of at least 53 previous cultural resource investigations were identified within the project area. Because detailed maps showing areas surveyed are not available from the Wyoming

SHPO office, the location of some projects is less than definite. Ninety archaeological and historical sites and isolates have been recorded within the project area. Of these, six have formally been determined eligible for listing on the National Register by the Wyoming SHPO. Five others are thought to be eligible for listing, but no formal determination has been made. Sixty-one sites have been determined not eligible for listing on the National Register and the eligibility of the remaining 18 is undetermined.

The results of previous cultural resource investigations in the project area are summarized by link number in Table 3-4. The higher number of total sites is due to more than one link crossing the same project. This is also true of intersections where the proposed link may intersect with a previous cultural resource investigation more than once. Based on previous cultural resource investigations, areas with the highest probability of containing sites are expected to be those located near permanent water sources in uncultivated areas. Areas with a medium probability of containing sites are those located in uncultivated uplands away from permanent water courses. Areas with the lowest probability for containing sites are those that have been cultivated or subject to other unnatural disturbances.

Due to the sensitive nature of cultural resources, site specific legal locations and maps showing the location of previous cultural resource investigations and sites were provided to Western as separate documents. These are not available for public inspection.

Because the project could affect sites associated with traditional Native American religious or cultural practices, the Shoshone and Arapahoe Tribes of the Wind River Reservation were contacted to identify any sacred sites or culturally sensitive areas within the study area. The tribes have not yet responded to this inquiry.

3.12 Socioeconomics and Community Resources

3.12.1 Population

Population in the vicinity of the study area increased from 1970 through the mid-1980s, but has been declining in the last half of the decade. Table 3-5 illustrates that Hot Springs County grew by 16 percent from 1970 to 1980 while Thermopolis was growing by 26 percent. The differential indicates that all of the county's growth occurred in Thermopolis while rural areas of the county were losing a small increment of population. Neither the town nor the county kept pace with the state which grew by over 41 percent from 1970 to 1980. Subsequent study area population losses through 1989 were also dominated by town figures according to local sources (Thermopolis 1989).

TABLE 3-4

Cultural Resource Information for the Carter Mountain-Thermopolis Transmission Line Project

	Type of Project					# of Sites Present NRHP Status[2]					Totals	
	Surveys				Mitigation							
Link No.	Linear	Block	Comb.[1]	Other	Excavation or Test	FE	E	NE	U	Intersections with Link	Projects	Sites
1	4	1	1					1	4	3	6	5
2	4	3	1	1				3	2	4	9	5
3a	1	3						1	1	2	4	2
3b	4	1				1		1		6	5	2
3c	4	1				1		2		6	5	3
3d	3							1			3	1
4	7	2			2			8	5	4	9	13
5	3	1						4		1	4	4
6	3	5	1		1	3	1	16	2	6	9	23
7	1	2						2		2	3	2
8											0	0
9	7	4	2			1		5	3	8	13	9
10		2									2	0
11	5	6						5	1	7	11	6
12	3							2	2		3	4
13	7	2		1	1			3	3	5	10	6
14	1										1	0
15	3	1					1	4		1	4	5

TABLE 3-4 (Continued)

	Type of Project					# of Sites Present NRHP Status[2]					Totals	
	Surveys				Mitigation							
Link No.	Linear	Block	Comb.[1]	Other	Excavation or Test	FE	E	NE	U	Intersections with Link	Projects	Sites
16	1							1		1	1	1
17	1	1						1		2	2	1
18	9	2	1	1				9	4	7	13	13
19	2	2		1				5	1	6	5	6
20	3	1	1			1		5	1	4	5	7
21	3	2						1	2	10	5	3
22	5			1	1			3	3	1	6	6
23	7	1			1			8	1	5	8	9
24	1									1	1	0
25	5	4	1		1		2	4	3	10	10	10
26	1										1	0
27	2							3		4	2	3
28	5	3	1		1	2	2		1	6	9	5

[1]Combination (Comb.) contains attributes of both linear and block surveys. Other surveys are those that do not fall into the three other categories.

[2]National Register Codes (NRHP):

FE = Formally determined eligible by the Wyoming SHPO.
E = Recommended eligible by researcher but has not yet been determined eligible by the Wyoming SHPO.
NE = Not eligible.
U = Undetermined.

TABLE 3-5

Hot Springs County and Thermopolis Population

Jurisdiction	1970[1]	1980[1]	1985[2]	1989[2]	Average Annual Change (%) 1970-1980	Average Annual Change (%) 1980-1989
Wyoming	332,416	469,557	509,000	475,000	3.5	0.1
Hot Springs County	4,942	5,710	5,710	4,800	1.5	-1.9
Percent of State	1.5	1.2	1.1	1.0	---	---
Thermopolis	3,063	3,852	4,000	3,000	2.3	-2.7
Percent of County	62.0	67.5	70.1	62.5	---	---

Sources: U.S. Department of Commerce, Census Bureau 1985; Thermopolis 1989.

[1]Actual.

[2]Estimated.

3.12.2 Economic Base

Growth and decline in study area population over the past two decades were probably generated mainly by fluctuations in the pace of natural resource development, especially oil and gas production and supporting services. Agricultural activity has also been declining, however. Numbers of cattle and calves on Hot Springs County farms and ranches are 20 percent below the mid-1970s levels and stock sheep levels are down by one-third. Barley acreage planted and harvested, though small to begin with at 2,400 acres (1978), is down by more than half to 1,000 acres in 1986. Only hay production is up significantly with acreage increasing from 17,300 in 1977 to 23,000 in 1986, while production more than doubled from 31,890 tons to 66,200 tons over the same period.

From an employment perspective, the most prominent industries in the county are government, services, trade, and mining (Table 3-6). Government and services (combined) have grown over the past decade, while most other industry sectors have declined both in numbers and in relative importance. Wholesale and retail trade, taken together, have grown slightly. Mining (including oil and gas) and construction have experienced significant declines from a combined total of 437 workers and almost 23 percent of county employment in 1979 to 256 workers and less than 14 percent of total county employment in 1989.

The unemployment rate in Hot Springs County is currently estimated at 4.4 percent compared with 5.1 percent for the state as a whole (Gallagher 1990).

3.12.3 Housing

There are approximately 1,853 permanent housing units in Hot Springs County, not counting senior housing, with at least 72 units, or 3.9 percent, believed to be vacant (Thermopolis 1989). The estimated population decline from 1985 to 1989 suggests, however, that the vacancy rate may be notably higher. There are 138 multi-family units in the county, 25 of which are estimated to be vacant rental units (Thermopolis 1989).

Hot Springs County has 11 motels and hotels with 193 rooms and 5 RV parks with 171 spaces (Thermopolis 1989). Occupancy rates are not available for transient housing facilities, but they are presumed to be full or nearly so during peak summer tourism periods.

TABLE 3-6

Hot Springs County - Employment by Industry
1979 and 1989

	First Quarter Average Employment			
	1979		1989	
Industrial Sector	**Number**	**Percent**	**Number**	**Percent**
Ag, Forestry, Fisheries	---[1]	---	57	3.0
Mining	333	17.4	199	10.6
Construction	104	5.4	57	3.0
Manufacturing	24	1.3	11	0.6
T.C.U.[2]	104	5.4	84	4.5
Wholesale Trade	28	1.5	113	6.0
Retail Trade	377	19.7	295	15.8
F.I.R.E.[3]	74	3.9	60	3.2
Services	744[1]	38.9	393	21.0
Government	123[1]	6.4		
Federal	---	---	17	0.9
State	---	---	89	4.8
Local	---	---	497	26.6
TOTAL	1,911	99.9	1,872	100.0

Source: Wyoming Department of Employment 1990.

[1]Definitional changes between 1979 and 1989 make numbers for some industry classifications inconsistent.

[2]Transportation, Communication, and Public Utilities.

[3]Finance, Insurance, and Real Estate.

3.12.4 Fiscal Conditions

Assessed valuation in Hot Springs County totaled $102,056,517 for 1989, down over 22 percent from the 1988 total of $131,624,458 (Wyoming 1989). Taxes levied for all purposes totaled $6,023,510, more than half of which was collected for schools (Wyoming 1989). Sales and use taxes are assessed at 4.0 percent in Hot Springs County, 3.0 percent to the state and 1.0 percent to the county.

3.13 Transportation and Communications

The major highway in the study area is Wyoming 120, a paved primary route running the length of the corridor in a northwest-southeast direction. Wyoming 431, a paved secondary route, runs east from 120 along Gooseberry Creek. Wyoming 120 intersects Wyoming 789/U.S. 20 at Thermopolis providing access southeast to Casper and southwest to Riverton and Lander. Wyoming 120 also intersects U.S. 20 at Cody providing access west to Yellowstone National Park and north to Montana. Improved local roads are uncommon in the area because both range productivity and population density are relatively low. There is a network of unimproved trails and roads providing access to much of the area in good weather, however.

The Burlington Northern provides rail service through Thermopolis. The Hot Springs County Airport, located just outside the study area in northeast Thermopolis, has a 4,950 foot asphalt runway, landing lights and an instrument landing system (Thermopolis 1989).

Thermopolis has an AM radio station and a cable TV system. Phone service is provided by U.S. West. The study area is host to three existing major electric transmission lines ranging from 69-kV to 230-kV and a natural gas pipeline.

4.0 ENVIRONMENTAL CONSEQUENCES

The overview of impacts includes all potential impacts which could occur from construction and operation of the proposed transmission line within the study area. The comparison of links discusses specific impacts as they relate to particular links, and finally there is a more detailed discussion of the specific impacts as they relate to Western's proposed route.

4.1 Climate and Air Quality

4.1.1 Overview of Impacts

Local climatological conditions would not be affected by construction or operation of the proposed transmission line. A small amount of dust would be produced by construction activities during dry periods, but this would not greatly exceed the dust generated by normal road traffic. No long-term air quality impacts would result from line construction or operation.

4.1.2 Comparison of Links

The short-term, minor impacts to air quality that would result from the proposed project would not differ among links.

4.1.3 Impacts of Western's Proposed Route

All state or Federal air quality standards would be complied with during construction and operation of Western's proposed route and there would be no significant impacts to climate and air quality.

4.2 Paleontology, Geology, and Soils

4.2.1 Overview of Impacts

Paleontology. Several potential fossil bearing formations occur in the study area; however, no protected paleontological resources (vertebrate fossils) have been documented in the study area. Under federal legislation, only vertebrate fossils found on federal land are protected against collection and destruction.

Geology. The majority of the links cross geologic formations of sandstone, shale, alluvium, and claystone that should provide an adequate foundation for tower structures. No landslide deposits would be crossed. One small liquefaction prone area is crossed along the narrow bottomland of Owl Creek. Transmission tower placement should not occur in this narrow bottomland. No other geologic hazards are expected along route options.

Soils. A total of approximately 2.02 miles of prime farmland soils occur along the links, although only a small portion of this total would be crossed by any one route alternative. The majority of this land occurs along the bottomlands of Owl Creek, Grass Creek Basin, and Gooseberry Creek. The majority of these soils have a sandy loam, loam, or silt loam texture and are stable.

Slopes of 15 to 30 percent occur along 7.59 miles and slopes greater than 30 percent occur along 3.18 miles of the total link lengths. Some increased wind and water erosion may occur in these areas until vegetation is reestablished, although it is expected that most of these areas would be spanned and would not require structure construction.

4.2.2 Comparison of Links

There are no known protected paleontological sites crossed by any of the links. All links, except for Links 3c, 3d, 5, 10, 12, 14, 15, 20, 24, and 26 cross small distances of slopes greater than 30 percent. Links 6, 25, and 28 cross a small liquefaction prone area along the narrow bottomland of Owl Creek.

Most individual links do not cross prime farmland soils, but a few links do cross small amounts of prime farmland acreage. Link 6 crosses approximately 0.97 mile, Link 11 crosses 0.8 mile, Link 25 crosses 0.14 mile, and Link 28 crosses 0.11 mile of prime farmland soils.

4.2.3 Impacts of Western's Proposed Route

If vertebrate fossils are encountered during construction, work would stop immediately, and a qualified paleontologist would be contacted to determine the scientific importance of the fossils. If the fossils are found on public land, BLM would also be contacted. No significant impacts should occur to paleontological resources along Western's proposed route.

Western's proposed route would cross one small liquefaction prone area along the narrow bottomland of Owl Creek; however, transmission tower placement should not occur in this area. There are no other geologic hazards expected along the proposed route; consequently, Western's proposed route would have no significant impacts associated with geological features.

No significant impacts should occur to soil resources along Western's proposed route. Western's proposed route would cross a total of 2.11 miles and 1.01 miles of moderate and excessive slopes, respectively. Western would span these areas to the extent feasible. If spanning is not possible, Western would stabilize the area and reestablish vegetation within 5 years to minimize wind and water erosion. Western's proposed route would cross 0.11 mile of prime farmland, mostly along the narrow bottomland of Owl Creek. Vehicular traffic across prime farmland soils would be kept to a minimum and would occur only during construction activities. This additional vehicle traffic should not significantly increase compaction to the point of lowering cropland productivity.

4.3 Water Resources

4.3.1 Overview of Impacts

Although the study area traverses rangeland with relatively high topographic relief, some construction within the 100-year floodplain may be necessary near Owl, Cottonwood, Grass, and Gooseberry Creeks. The transmission line structures, however, would be placed out of the active channel, minimizing the amount of disturbance created by the individual structures. Impacts to area water resources would exist from removal of bank vegetation or tree cover along these riparian drainages during construction activities. Loss of vegetation may increase run-off, resulting in increased rill, sheet, or gully erosion; an increase in streambank erosion may then lessen bank stability and result in increased channel sedimentation. An increase in suspended solids and subsequent siltation from transmission line or access road construction would degrade the existing water quality within these specific streams.

4.3.2 Comparison of Links

All links crossing Owl, Cottonwood, Grass, and Gooseberry Creeks are essentially the same in terms of overall potential impacts resulting from the crossings. There may be slight differences in impacts, due to vegetation types present and the difference in length of the line required to cross riparian areas for each of these small streams.

Links 3b, 3c, 3d, 5, 7, 8, 10, 11, 14, 15, 16, 17, 19, 21, 22, 24, 26, and 27 cross no riparian/wetland areas. Of the remaining links, Link 13 crosses the largest riparian/wetland area (0.4 mile) and Link 12 crosses the smallest riparian/wetland area (0.02 mile). The remaining links cross from 0.08 to 0.36 mile of riparian areas.

In general, the link requiring the least distance of riparian/wetland area to be crossed would result in the least potential impact. The overall difference in any potential impacts between the various crossings would be minor.

4.3.3 Impacts of Western's Proposed Route

No significant impacts are anticipated for trout fisheries associated with the stream channels crossed by Western's proposed route because of the lack of concentrated trout populations in the project area (see Section 4.7). In addition, any sedimentation that occurs would not adversely affect the operation of irrigation water control structures. Western's standard construction practices listed in Section 2.1.2, Table 2-4, would preclude surface water contamination from accidental oil or gasoline spills. State water quality criteria would not be violated by construction of Western's proposed route. No impacts would occur to water resources during project operation.

4.4 Floodplains and Wetlands

4.4.1 Overview of Impacts

The floodplains located along Owl, Cottonwood, Grass, and Gooseberry Creeks are the only floodplains potentially impacted by the proposed transmission line. Small wetland areas crossed by the various links are restricted to limited zones immediately adjacent to small perennial and intermittent streams. All these areas would be spanned by the transmission line. Control of woody vegetation under the transmission line would not be required.

4.4.2 Comparison of Links

Currently, 14 links cross floodplain areas; whereas, Links 1, 3b, 3c, 3d, 5, 7, 8, 10, 14, 15, 16, 17, 19, 21, 24, 26, and 27 cross no floodplains or perennial streams. Link 6 crosses 1.5 miles of floodplain along Owl Creek and Links 4 and 23 each cross a total of 1.0 mile of floodplain along both Cottonwood and Grass Creeks. The remaining 11 links within the study area cross from 0.06 to 0.76 mile of floodplain areas. Section 4.3.2 contains a comparison of links for riparian and wetland areas.

No significant impacts should occur to soil resources along Western's proposed route. Western's proposed route would cross a total of 2.11 miles and 1.01 miles of moderate and excessive slopes, respectively. Western would span these areas to the extent feasible. If spanning is not possible, Western would stabilize the area and reestablish vegetation within 5 years to minimize wind and water erosion. Western's proposed route would cross 0.11 mile of prime farmland, mostly along the narrow bottomland of Owl Creek. Vehicular traffic across prime farmland soils would be kept to a minimum and would occur only during construction activities. This additional vehicle traffic should not significantly increase compaction to the point of lowering cropland productivity.

4.3 Water Resources

4.3.1 Overview of Impacts

Although the study area traverses rangeland with relatively high topographic relief, some construction within the 100-year floodplain may be necessary near Owl, Cottonwood, Grass, and Gooseberry Creeks. The transmission line structures, however, would be placed out of the active channel, minimizing the amount of disturbance created by the individual structures. Impacts to area water resources would exist from removal of bank vegetation or tree cover along these riparian drainages during construction activities. Loss of vegetation may increase run-off, resulting in increased rill, sheet, or gully erosion; an increase in streambank erosion may then lessen bank stability and result in increased channel sedimentation. An increase in suspended solids and subsequent siltation from transmission line or access road construction would degrade the existing water quality within these specific streams.

4.3.2 Comparison of Links

All links crossing Owl, Cottonwood, Grass, and Gooseberry Creeks are essentially the same in terms of overall potential impacts resulting from the crossings. There may be slight differences in impacts, due to vegetation types present and the difference in length of the line required to cross riparian areas for each of these small streams.

Links 3b, 3c, 3d, 5, 7, 8, 10, 11, 14, 15, 16, 17, 19, 21, 22, 24, 26, and 27 cross no riparian/wetland areas. Of the remaining links, Link 13 crosses the largest riparian/wetland area (0.4 mile) and Link 12 crosses the smallest riparian/wetland area (0.02 mile). The remaining links cross from 0.08 to 0.36 mile of riparian areas.

In general, the link requiring the least distance of riparian/wetland area to be crossed would result in the least potential impact. The overall difference in any potential impacts between the various crossings would be minor.

4.3.3 Impacts of Western's Proposed Route

No significant impacts are anticipated for trout fisheries associated with the stream channels crossed by Western's proposed route because of the lack of concentrated trout populations in the project area (see Section 4.7). In addition, any sedimentation that occurs would not adversely affect the operation of irrigation water control structures. Western's standard construction practices listed in Section 2.1.2, Table 2-4, would preclude surface water contamination from accidental oil or gasoline spills. State water quality criteria would not be violated by construction of Western's proposed route. No impacts would occur to water resources during project operation.

4.4 Floodplains and Wetlands

4.4.1 Overview of Impacts

The floodplains located along Owl, Cottonwood, Grass, and Gooseberry Creeks are the only floodplains potentially impacted by the proposed transmission line. Small wetland areas crossed by the various links are restricted to limited zones immediately adjacent to small perennial and intermittent streams. All these areas would be spanned by the transmission line. Control of woody vegetation under the transmission line would not be required.

4.4.2 Comparison of Links

Currently, 14 links cross floodplain areas; whereas, Links 1, 3b, 3c, 3d, 5, 7, 8, 10, 14, 15, 16, 17, 19, 21, 24, 26, and 27 cross no floodplains or perennial streams. Link 6 crosses 1.5 miles of floodplain along Owl Creek and Links 4 and 23 each cross a total of 1.0 mile of floodplain along both Cottonwood and Grass Creeks. The remaining 11 links within the study area cross from 0.06 to 0.76 mile of floodplain areas. Section 4.3.2 contains a comparison of links for riparian and wetland areas.

4.4.3 Impacts of Western's Proposed Route

The construction of transmission line structures and the physical presence of structures during operation are not expected to alter the floodplain storage volume or cause a local increase in the flood stage. The final design for the transmission structure foundations will consider site-specific soil conditions, as well as the elevation of the 100-year flood and potential debris loading of the structure during a flood. For these reasons, failure of a structure during a flood is not expected. No applicable floodplain protection standards would be violated. Public meetings were held and the public was informed of potential activities in the floodplain. Therefore, construction of Western's proposed route would substantively comply with DOE floodplain/ wetlands environmental review requirements as presented in 10 CFR 1022 and no significant impacts to floodplains are anticipated.

Riparian and wetland areas crossed by Western's proposed route are small (from 0.08 to 0.2 mile) and scattered along the drainages. It is estimated that construction at each of the four perennial streams crossed by the proposed route would result in no long-term loss of riparian or wetland vegetation since each crossing would be spanned.

4.5 Vegetation

4.5.1 Overview of Impacts

Riparian areas located adjacent to the various stream crossings would be spanned and avoided. The vegetation occurring in the other corridor areas would sustain minimal and short-term damage. Agricultural lands would not be taken out of production as a result of transmission line construction. Disturbance of vegetation in rangeland areas would not reduce forage production or grazing capacity. The impacts to vegetation associated with wetlands are discussed in Section 4.4.

4.5.2 Comparison of Links

After transmission line construction, subsequent vegetation regrowth would be permitted. Any regrowth of cottonwood trees within the ROW would be cleared as needed. All other plant species would be allowed to grow beneath the transmission lines. Very small areas (less than 1 acre) of long-term destruction of riparian habitats would occur in links where riparian habitat is crossed.

4.5.3 Impacts of Western's Proposed Route

Riparian and wetland areas crossed by Western's proposed route are small (from 0.08 to 0.2 mile) and scattered along the drainages. It is estimated that construction at each of the four perennial streams crossed by the proposed route would result in no long-term loss of riparian or wetland vegetation since each crossing would be spanned.

4.6 Wildlife

4.6.1 Overview of Impacts

Riparian habitat is the most sensitive habitat type present; it provides ecological diversity for numerous wildlife species that inhabit the area. Impacts from transmission line or access road construction could include removal of the tree canopy, disturbance of bank vegetation, and increased erosion resulting in stream sedimentation. The proposed transmission line would span riparian areas, thereby reducing the amount of disturbance. As stated in Section 2.1.2, Table 2-4, Western's standard construction practices adjacent to a watercourse would be implemented to minimize vegetation removal and bank disturbance and to prevent an increase in the siltation of aquatic areas.

Significant impacts would not be associated with the proposed line crossing the small reservoirs or stock ponds that are numerous throughout the region. Although a few of these water resources are maintained for wildlife use, species' concentrations are not anticipated to be large enough to present a potentially significant problem from line strikes or from increased predation.

Transmission line and access road construction would result in the displacement or loss of small, less mobile wildlife species within the areas of disturbance. Amphibians, reptiles, and small mammals would be more subject to construction-related mortality than other groups.

Some species of ground-nesting birds would be precluded from nesting within the area of disturbance during construction. Some of the more common ground-nesters (e.g., western meadowlark, ring-necked pheasant) would likely use surrounding habitats and return to nesting habitats within the transmission line ROW following reclamation. An exception would be the sage grouse, whose breeding areas are highly sensitive to disturbances and may be affected during both project construction and operation. Sage grouse leks or strutting grounds are shown on Map 2-2 and represent active breeding areas. Disturbances from transmission line construction to leks or nesting areas during the breeding period would affect breeding birds, possibly preventing successful reproduction. Impacts to active lek areas during project operation may result from increased predation on breeding birds from raptors using adjacent transmission line structures as perch sites. Leks that are currently located near power lines within the project area have previously exhibited lower reproductive success rates due to this factor (Denton 1989).

Construction activities located on established lek areas or nesting grounds from March 15 to April 30 could significantly impact breeding birds, consequently affecting the overall local population. A potential increase in raptor predation from project operation, however, would not be considered significant.

Potential effects to waterfowl species from mortality associated with collisions with transmission line conductors and static wires during project operation would not be considered significant. Waterfowl concentrations have not been identified in association with the areas crossed by potential routes (Ritter 1989; Denton 1989). Therefore, occasional flocks or individuals that utilize the reservoirs, ponds, and riparian zones found throughout the area would not be significantly impacted by the line.

Transmission line construction occurring near an active raptor nest would likely impact the individuals inhabiting the site, possibly resulting in loss of reproduction for that year. Nest sites could be active as early as the end of February (e.g., golden eagle) through the end of July; however, this period is dependent on the species that may be nesting (Denton 1989). Known species that maintain active nest sites within 0.5 mile of the proposed transmission line links include the red-tailed hawk, American kestrel, and golden eagle (Ritter 1989). Additional species and nest sites may also occur.

Potential collisions by waterbirds, game birds, or raptors during operation may occur along the length of the transmission line. Raptors may be susceptible to power line strikes when preoccupied or distracted (e.g., territorial defense, prey pursuit) (Thompson 1978). However, several physical and behavioral attributes of raptors, such as keen eyesight, slow flight speed, maneuverability in flight, and use of utility poles for perch sites, decrease their susceptibility to collisions. Studies suggest that collisions with utility lines do not result in a noticeable effect on raptor population dynamics, except in the case of critically endangered species or when rare, threatened, or endangered species are experiencing population declines (Olendorff and Lehman 1986). Occasional line strikes from raptors and other bird species found in the project area would not significantly affect these local populations.

As discussed in Section 3.6.2, crucial winter range for both mule deer and pronghorn occurs throughout the entire study area; wintering periods occur between November 15 through April 30 (Hurley 1989; Denton 1989). Disturbance from construction activities that would force individuals to avoid areas associated with line construction, thereby potentially reducing the amount of winter habitat available, could adversely affect wintering populations for both of these

species. Location of the transmission line and associated access roads through crucial winter range would also increase accessibility, potentially resulting in increased disturbances to wintering populations.

Additional concerns for pronghorn include sensitive fawning sites and important migration routes that could be disrupted by project construction. Fawning areas are active from approximately May 1 through June 30; whereas, pronghorn use of migration routes is contingent on existing weather patterns and environmental conditions. During the fall season, the animals will typically begin moving after November 1, and the migration may continue for a few days up to a month, depending on weather conditions. The spring period may be even more variable, with animals beginning to move in April or May and continuing into the early summer. Therefore, overall migration periods would include from November 1 to December 15 in the fall and April 1 to June 15 for the spring (Denton 1989).

Construction activities occurring within pronghorn fawning areas from May 1 through June 30 could significantly affect the individual reproductive success of those animals within these specific areas. Depending on the environmental conditions present during pronghorn migration, line construction may also impact animals moving between ranges, particularly if animals begin to move into summer range and weather forces them back into the wintering areas. Construction activities occurring between these areas could prevent this movement during critical periods (Denton 1989).

Impacts to other game species (e.g., mourning dove, beaver, red fox) occurring in the area would be temporary during the construction period. Species would avoid the area during construction; however, because the proposed line would not permanently alter a substantial portion of important habitat for these species (e.g., riparian drainages, hedgerows, native grasslands), individuals would likely return within one or two breeding seasons following ROW reclamation.

Aquatic resources crossed by the proposed project would be spanned by the transmission line, with minimal disturbance to riparian areas associated with the stream crossings. Access road construction could have a greater impact on these resources, depending on the stream crossing location, sensitivity of the organisms inhabiting the drainage, and the timing of the construction period. Potential impacts to aquatic species would include removal of riparian vegetation and increased sedimentation resulting in water quality degradation.

Removal of bank vegetation or cover along the riparian areas during construction activities may increase water temperatures, potentially degrading the habitat for aquatic species. Reduction of bank stability from transmission line or access road construction may result in a temporary increase in suspended solids and subsequent siltation if stream banks and/or floodplains were disturbed.

4.6.2 Comparison of Links

The comparison of riparian and wetland habitats crossed by project links is discussed in Sections 4.3.2 and 4.4.2. The western portion of the study area contains a greater number of small ponds or reservoirs improved for wildlife use than the eastern perimeter. Links 2, 3a, 3c, 4, 5, 6, 7, 13, 15, and 20 cross these areas along the western edge of the project area; Links 21 and 25 cross improved ponds along the eastern portion.

A number of currently-known sage grouse breeding leks occur throughout the project area and are crossed by many of the route segments. In the northern part, Link 18 crosses 10.02 miles of sage grouse production areas as compared to 5.2 miles crossed by the combination of Links 1 and 2 and along Link 9. In addition, Links 19 and 21 show 4.1 and 4.65 miles crossed, respectively, compared to Link 11 that contains no breeding areas. Links 4, 13, and 23 are similar, showing 5.52, 5.67, and 4.97 miles crossed, respectively, as are Links 7 and 17 at 1.9 and 1.89 miles.

Links 1, 2, 7, 9, 11, 17, 21, 22, 23, and 28 are each located within 0.5 mile of one active raptor nest currently reported by the WGFD (Ritter 1989). Link 18 traverses within 0.5 mile of two nest sites.

Because crucial winter range for both mule deer and pronghorn is so widespread throughout the area, a majority of the project segments intersect these sensitive areas. Crucial wintering areas range from 0.16 mile along Link 14 to 9.37 miles along Link 11. Only four links do not cross crucial winter range for these species; they are Links 7, 8, 17, and 28. As shown on Map 2-2, Links 7, 8, 17, and 28 occur near Thermopolis.

Pronghorn fawning areas exist along the northeast portion of the study area. Five project segments cross these sensitive areas, with Link 18 crossing 5.6 miles, Link 19 crossing 0.95 mile, Link 21 crossing 0.79 mile, Link 22 crossing 0.32 mile, and Link 23 crossing 2.44 miles. The links located along the western area would not affect pronghorn fawning grounds.

As stated in Section 3.6.2, important pronghorn migration routes exist predominantly between Grass and Cottonwood Creeks and north of Gooseberry Creek past the Carter Mountain Substation. Link 18 crosses 14.03 miles of migration territory as compared to 6.36 miles for

Links 1 and 2, 5.62 miles for Links 1 and 20, and 5.56 miles for Link 9. Links 4, 13, and 23 are similar with 5.48, 5.63, and 5.48 miles, respectively.

The four perennial streams that flow through the study area include Owl, Cottonwood, Grass, and Gooseberry Creeks. Links 2, 4, 6, 9, 13, 18, 20, 23, 25, and 28 cross these 4 channels a total of 13 times. Links 4, 13, and 23 cross both Cottonwood and Grass Creeks; whereas, the remaining segments cross only 1 drainage. Specific data on floodplain and riparian areas crossed in relation to these perennial streams are discussed further in Sections 4.3.2 and 4.4.2.

4.6.3 Impacts of Western's Proposed Route

As shown on Map 2-2, the proposed transmission line would either parallel existing ROWs or be placed within Western's present 69-kV ROW along a majority of the proposed route. This would aid in minimizing impacts to native habitats and the wildlife species dependent on them. The habitat types potentially crossed by the line would not be significantly impacted by the proposed construction and operation activities; although restoration of native vegetation may require many years, following reclamation activities.

Riparian and wetland areas crossed by Western's proposed route are small (from 0.08 to 0.2 mile) and scattered along the drainages. It is estimated that construction at each of the four perennial streams crossed by the proposed route would result in no long-term loss of riparian or wetland vegetation since each crossing would be spanned.

The proposed route would cross 24.8 miles of crucial winter range; 11.1 miles of pronghorn migration routes; and 9.4 miles of sage grouse production areas. The proposed route would not cross any known pronghorn fawning areas. The project construction schedule described in Section 2.1.1.3 was developed to be long enough to accommodate critical wildlife periods and seasonal constraints, and no significant impacts are anticipated.

The proposed route is located within 300 yards of active golden eagle and red-tailed hawk nest sites. Disturbance to these active nests during the breeding season would likely limit individual production for that year, resulting in an adverse impact to those breeding individuals (Denton 1989).

Potential effects to waterfowl species from mortality associated with collisions with transmission line conductors and static wires during project operation would not be considered significant. Waterfowl concentrations have not been identified in association with the proposed route and the area that it crosses (Ritter 1989; Denton 1989). Therefore, occasional flocks or individuals that utilize the reservoirs, ponds, and riparian zones found throughout the area would not be significantly impacted by the proposed route.

Trout fisheries would not be significantly impacted by construction of the proposed route, primarily due to the lack of trout species' concentrations in the areas within the project area. In addition, the probability of accidental oil or gasoline spills would be minimal since refueling machinery would not be conducted near stream crossings, as outlined in Western's standard construction practices in Section 2.1.2, Table 2-4.

No impacts to aquatic resources are expected during project operation. Ground surveys for maintenance activities would produce minimal impacts on these resources along the route since maintenance vehicles would use existing access roads, or protection measures would be implemented if closed roads were reopened for line repair.

4.7 Sensitive Species

4.7.1 Overview of Impacts

Bald eagles occupy winter range along the Bighorn River from approximately October through March. Occasional individuals may forage in the study area during the winter months, particularly in open water areas and near winter concentrations of other species (Ritter 1989). Construction activities during this period would inhibit eagles from occupying the areas near the disturbance; however, individuals would likely use this habitat upon completion of construction. No communal roost sites are recorded within the project area (Ritter 1989), and electrocution of eagles is not considered a problem with transmission lines (Olendorff et al. 1981). Therefore, significant impacts to bald eagles would not be anticipated from the construction or operation of the proposed project.

No impacts to the peregrine falcon, a rare migrant, are expected from the proposed project. However, disturbance to active nest sites for other rare bird species that may breed in the area would likely limit individual production for that year, affecting other sensitive species such as the ferruginous hawk, Swainson's hawk, burrowing owl, long-billed curlew, and mountain plover.

No black-footed ferrets are known to presently exist in the wild. Impacts to this species cannot be assessed until active prairie dog colonies are identified and ferret clearance surveys are conducted, if required by the USFWS. These activities to determine if active white-tailed prairie dog colonies are supporting a viable ferret population will be conducted prior to construction initiation. The spotted bat, Allen's thirteen-lined ground squirrel, and wild horses would not be

affected by the proposed project, due to their rare occurrence within the study area and to their specific habitat requirements.

There are no federally or state-listed (threatened or endangered) plant species found within the study area. Cymopterus evertii (Evert's Waferparsnip), a plant designated by the Wyoming Natural Diversity Database as a species of special concern, has been observed about 2 miles east of the Carter Mountain Substation.

4.7.2 Comparison of Links

Link 18 crosses 1.76 miles of potential habitat for Cymopterus evertii (a special concern species). Areas within this potential habitat where ground disturbance would occur would be surveyed for the plant prior to construction. Impacts to the plant should not be significant. No other threatened, endangered, or sensitive plants are known to occur along any of the other links.

4.7.3 Impacts of Western's Proposed Route

A Biological Assessment has been prepared for submittal to the USFWS for review of the impacts of the proposed action on the bald eagle, peregrine falcon, and black-footed ferret in compliance with Section 7(a)(2) of the Endangered Species Act of 1973, as amended. This assessment is presented as Appendix B of this document. No significant impacts to the bald eagle, peregrine falcon, and black-footed ferret are expected from construction and operation of the proposed route.

No threatened, endangered, or sensitive plants are known to occur along Western's proposed route; consequently, there would be no significant impacts from disturbance.

4.8 Land Uses, Plans, and Zoning

4.8.1 Overview of Impacts

The alternative links for the proposed transmission line are located virtually entirely on rangeland except for minor incursions over irrigated pasture or hay land along 4 of the 25 links. The proposed line would have no long-term effects on irrigated areas because there are no elevated irrigation systems and the proposed line would replace an existing 69-kV line along Link 6.

There are few occupied residences along any of the links. Only two of the six links that would pass within 0.25 mile of a residence are new alignments; the others parallel existing transmission lines. The proposal would comply with state policies regarding utility corridors by affording review and comment to all jurisdictions, seeking compatibility with existing land use plans and regulations, and complying with NEPA. The proposed line would not adversely affect views of Round Top Mountain from Thermopolis and Highway 120, and would not conflict with other local policies or regulations.

The proposed transmission line would not conflict with BLM plans to continue grazing management in the study area. Most links would parallel existing transmission corridors, although part of Link 18 and Links 19, 22, and 24 would deviate from existing corridors for distances ranging from less than 1 mile (Link 24) to almost 9 miles (Link 18).

4.8.2 Comparison of Links

Eighteen of the 31 links parallel or replace existing transmission lines for the entire link length including Links 1 through 7, 9, 11, 13, 20, 21, 23, 25, and 28. Links 15, 16, 18, and 27 parallel existing lines for part of their length. Only Links 17, 18, 19, and 22 would require more than 1.0 mile of new ROW.

Links 2, 6, 25, and 28 cross cropland for 0.14, 1.01, 0.18, and 0.28 miles, respectively. No other links would cross cropland.

Links 2, 6, 8, 11, 17, and 18 would pass within 0.25 mile of a residence. Link 6 would be within 0.25 mile of 5 residences; the others are near only 1 residence each. Link 6 contains the existing Western 69-kV line.

4.8.3 Impacts of Western's Proposed Route

The construction and operation of Western's proposed route would have no significant impacts on land uses, plans, and zoning.

4.9 Recreation

4.9.1 Overview of Impacts

The proposed transmission line would have essentially no effect on recreation facilities or resources. None of the links would be near recreation facilities. The links would cross areas used for hunting and fishing and similar low use dispersed recreation areas, but they would not affect functional enjoyment of those resources. Aesthetic considerations are addressed in Section 4.10.

4.9.2 Comparison of Links

There would be little or no substantive difference among links regarding functional effects on recreation opportunities. Link 18 may improve access somewhat to an otherwise remote area.

4.9.3 Impacts of Western's Proposed Route

The construction and operation of Western's proposed route would have no significant impacts on recreation resources.

4.10 Visual Resources

4.10.1 Overview of Impacts

The visual effects of a new or reconstructed transmission line are typically evaluated by analyzing the degree to which the proposed project would contrast visually with the existing environment. For the Carter Mountain-Thermopolis line, the contrast rating guidelines and procedures of the BLM VRM system were applied, including use of the standards noted in the VRM Management Class Objectives (Table 3-3). The procedures address the major features of the landscape: land and water features, vegetation, and structures. The proposed project was evaluated for the degree of contrast it would introduce in each feature class in terms of the major design elements: form, line, color, and texture.

In the case of the proposed project, there would be no visual changes to water features and only very minor changes to landform and vegetation. The changes would be limited to small areas of color contrast from surface disturbance that exposes soil during construction. Much of the contrast should be largely eliminated when disturbed areas have been revegetated. There may be continuing linear features introduced where new access roads would be required. The main visual concern, however, would be the potential for structural contrast from towers and conductors.

The amount of visual contrast that would be acceptable is governed by VRM Class Objectives. Most of the study area is VRM Class III, which permits activities to attract the attention of casual observers but not to dominate their views. The area south of Owl Creek is the more restrictive VRM Class II, which specifies that the proposed action should not attract attention.

Visual contrast and degree of visual dominance from the proposed project would vary depending on whether the transmission line would replace an existing line, parallel an existing line, or blaze a new route where none currently exists. The location of the line relative to sensitive viewers would also be important, though this is reflected in the VRM class rating.

For a line segment replacing an existing line, visual contrast would be increased to a minor degree. Existing H-frame structures to be removed are typically wood poles 50 to 80 feet tall. Their variegated brown coloring blends well with the natural landscape. Proposed structures would be larger and may be metal poles. Color contrast and scale would be increased somewhat, though the net change would be minor.

For line segments paralleling existing transmission lines, the introduced visual contrast would be minor. Pole colors may contrast with existing poles somewhat but the most prominent feature of a transmission line is its vertical and horizontal linearity. This effect would be shared with the existing line. Thus, the net visual effect would be a minor expansion of existing visual character and a slight increase in visual clutter.

Visual effects for new alignment segments would be greater than for replacement and parallel line segments, but would still only be moderate in the study area landscape because the scale of the landscape is so dominating, because the conductors mimic existing curvilinear horizontal lines, because color contrast with natural colors would be minor to moderate, and because the new ROW line segments would typically not be silhouetted against the horizon from sensitive viewpoints.

4.10.2 Comparison of Links

The most visually sensitive area in the study area is the VRM Class II area south of Owl Creek. Parts of Links 6, 7, 8, 17, 25, and 28 cross through this area. All of these links except 8 and 17 are replacement or parallel lines. New lines on either Link 8 or Link 17 would nevertheless be in the same viewshed with existing lines into the Thermopolis Substation from the study area and from outside the study area to the southwest. All six of these links would meet the standards of the VRM Class II objectives. Links 8 and 17 would be least preferable because they would be new alignments. Link 25 or Link 28 would be more favorable than Links 6 and 7 because they would parallel existing lines and would result in removal of the existing transmission line from the high visibility foreground viewshed of Highway 120.

Link 18 would include the longest segment of new alignment of any of the links but almost three-fourths of the new alignment would be in a seldom seen Class IV area so it would readily meet the visual management objectives.

Link 19 would be the second longest new alignment. It would meet the standards of the Class III area although it would cross Highway 431 which is considered a high sensitivity viewing route. Links 22 and 24 are also new alignments but they are very short links connecting to existing transmission corridors. They would meet the applicable VRM Class III standards.

The rest of the links are all either replacement or parallel alignments and are entirely in VRM Class III areas except for a small part of Link 21 which crosses a Class IV area. All of these links would meet the objectives of VRM Class III (and IV). In general, parallel alignments would be somewhat preferable to replacement alignments (Links 2, 3, and 6) because that would result in a consolidation of transmission lines in fewer corridors and removal of some highly visible foreground lines, notably on Links 2 and 6 and to a lesser degree on Link 3.

4.10.3 Impacts of Western's Proposed Route

Western's proposed route would cross 3.39 miles of sensitive scenic areas (BLM VRM Class II) north of Thermopolis. However, Western's proposed route would be more favorable than the existing 69-kV transmission line ROW in this area because it would parallel existing lines and would result in removal of the existing transmission line from the high visibility foreground viewshed of Highway 120. Western's proposed route would have no significant impacts on visual resources.

4.11 Cultural Resources

4.11.1 Overview of Impacts

Cultural resources are very sensitive to construction-related activities and increased access created by the addition or upgrading of roads. Anticipated impacts to cultural resources by the Carter Mountain-Thermopolis Transmission Line might include disturbances or destruction of prehistoric and historic sites that might qualify for listing on the National Register of Historic Places; disturbance to areas that are culturally sensitive to contemporary Native American Groups; accelerated erosion caused by construction; vandalism and destruction caused by increased public access; and visual impacts on historic sites caused by the construction of transmission line towers. The total extent and nature of impacts to cultural resources, however, would not be known until a Class III inventory of unsurveyed portions of the ROW and access easements had been conducted.

4.11.2 Comparison of Links

A total of 12 archaeological and historical sites are located within construction zones of 11 of the 31 links. No previously recorded sites are located in the construction zones of Links 3a, 3b, 3c, 3d, 5, 7 to 16, 21, 22, 24, 26, and 27. Cultural resources in the remaining links are discussed below.

One site is located in the construction zones of Links 1, 2, and 20. This site is the Thermopolis-Meeteetse Road (48HO472). The site is a historic freight road and is generally paralleled and occasionally subsumed by State Highway 120. No determination of National Register eligibility has been made for the site.

One site may be in the construction zone of Link 4. This is a prehistoric campsite (48HO115). The location of the site is based on the description on the site form and may be questionable. No determination of eligibility has been made for this site.

Two historic sites are located in the construction zone of Link 6. One of the sites is the Highland Coal Mine (48HO225). This site is thought to be eligible for listing on the National Register, but the Wyoming SHPO has not yet made a formal determination of eligibility. The other site is a historic bridge (48HO225) over an unnamed draw on State Highway 120. This site has been determined not eligible for listing on the National Register.

One site is located within the construction zone of Link 17. The site (48HO292) is a historic trash scatter that is not eligible for the National Register.

Three sites are located within the construction zone of Link 18. Two of the sites are prehistoric lithic scatters (48HO348 and 48HO456). 48HO456 also contains a scatter of fire-cracked-rock. Both sites have been determined not eligible for listing on the National Register. The remaining site (48HO465) is a historic freight road known as the Gooseberry Creek Road. This site is also located in Link 19. No determination of National Register eligibility has been made for the road.

One site is located in the construction zone of Link 23. This site (48HO214) is a prehistoric stone circle site with an associated lithic scatter. The site has been determined not eligible for listing on the National Register.

Two sites, whose locations are questionable, are located in the construction zone of Link 25. One site (48HO41) is a prehistoric campsite. The other site (48HO12) is a rock art site. No determination of eligibility has been made for either site.

One site is located within the construction zone of Link 28. This site is a prehistoric lithic scatter (48HO315). The site has been formally determined eligible for listing on the National Register by the Wyoming SHPO.

4.11.3 Impacts of Western's Proposed Route

Assessment of effects on cultural resources would necessitate an intensive (Class III) inventory of all unsurveyed lands within the selected ROW and access easements. Western would conduct the inventory prior to initiation of construction, in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and the provisions of 36 CFR 800. It would include the evaluation of significance for all recorded cultural resources that would be impacted by the project.

4.12 Socioeconomics

4.12.1 Overview of Impacts

Study area population changes due to construction of the proposed transmission line are expected to be minimal and of short duration. Construction is proposed to occur between the spring of 1993 and the summer of 1994. Table 2-2 shows the number of workers by activity for construction of the transmission line. The peak number of workers in the area would be 25 to 35. It is unlikely that any out-of-region workers would relocate their families for the relatively brief construction period. No significant amount of secondary employment or population growth is expected because of the low number of out-of-region workers and the brevity of the construction period.

Impacts to housing are not expected to be significant because of the relatively large number of motel rooms and RV spaces available in the area. There may be minor conflicts due to competition for transient housing during summer peak tourism season but they would be short-term effects. They would be somewhat offset in the local economy by increased demand for short-term housing in the off season.

Public facilities and services would not be significantly affected by construction of the proposed transmission line because project-related population changes would be temporary and notably smaller than population losses in the area in recent years.

Acquisition of additional or new ROWs would result in payments to private landowners along the selected alignment. This would result in an economic benefit to some local landowners. There

would be no change in property tax revenues as a result of the proposed project. The transmission line would be owned by the Federal government and would be tax exempt.

4.12.2 Comparison of Links

Impacts to socioeconomics and community resources would generally be the same regardless of which links are selected.

4.12.3 Impacts of Western's Proposed Route

The construction and operation of Western's proposed route would have no significant impacts on socioeconomics.

4.13 Transportation and Communications

4.13.1 Overview of Impacts

Only very minor traffic delays (less than 15 minutes) or interference with the study area highway system would result from project construction. Transmission line construction techniques should not require even temporary closure of main highways. Users of smaller gravel roads may experience minor delays. Western would work closely with state and county road departments, so that crossings are posted and detours provided where necessary.

No adverse effects on railroads or air traffic from the Hot Springs County Airport are expected. Prior to construction, appropriate notice will be given to the Federal Aviation Administration (FAA) and airport operators, if necessary, concerning potential for effects on airport operations.

No adverse effects to local communication networks are anticipated.

4.13.2 Comparison of Links

Links 6, 16, 18, 19, 22, and 24 cross Highway 120, the major traffic artery through the study area. Other links would cross only minor roads and some would parallel Highway 120. At least one crossing of Highway 120 will be required but the effects would not be significant and no significant difference between links has been identified.

4.13.3 Impacts of Western's Proposed Route

The construction and operation of Western's proposed route would have no significant impacts on transportation and communications.

4.14 Mitigation Measures

The following mitigation measures have been developed to supplement Western's standard construction practices (see Table 2-4).

4.14.1 Climate and Air Quality

No additional mitigation measures were deemed to be necessary for climate and air quality.

4.14.2 Paleontology, Geology, and Soils

<u>Paleontology</u>

- A qualified paleontologist will evaluate any reported paleontological resource locations discovered during construction activities. Appropriate scientific data recovery would be undertaken if impacts to the significant attributes of the paleontological resources could not be avoided by structure relocation.

<u>Geology</u>

- No additional mitigation measures were deemed to be necessary for geology.

<u>Soils</u>

- In potential soil erosion areas such as found on slopes greater than 30 percent, tower construction disturbance and movement of heavy equipment will be kept to a minimum. This measure will greatly reduce the potential for wind erosion.

4.14.3 Water Resources

- Construction activities will be conducted so as to not unnecessarily destabilize stream banks. Access roads will not cross these channels unless it is mandatory during project construction. In the event bank stabilizing vegetation is removed during project

construction, disturbed banks will be stabilized with large angular rock riprap (at least 2 feet in one dimension). Hard, durable rock (e.g., granite) will be used, if possible.

4.14.4 Floodplains and Wetlands

- Heavy equipment will not be allowed to cross the four perennial and one intermittent drainages and the associated riparian zones affected by the proposed project. These aquatic resources include Owl, Cottonwood, Grass, Gooseberry, and Buffalo Creeks, which will be avoided during both project construction and operation.

4.14.5 Vegetation

No additional mitigation measures were deemed to be necessary for vegetation resources.

4.14.6 Wildlife

The following mitigation measures were developed in conjunction with the WDGF and BLM, Grass Creek Resource Area. Anticipated construction and operation procedures were discussed in relation to the proposed route and the sensitive areas possibly affected. The following measures were then developed according to the specific issues and concerns applicable to the route.

- Staging areas for line construction will not be located within sensitive areas delineated by the state and federal agencies.

- Prior to construction, sage grouse surveys will be conducted between March 15 and April 15 to locate active lek areas crossed by the proposed route. Surveys will be initiated at separate locations for 3 consecutive mornings, stopping at 0.25-mile intervals along the ROW to determine any potentially active breeding areas.

- Construction activities will not commence on active sage grouse leks prior to 8:00 a.m. between March 15 and April 30 to prevent disturbances to breeding birds.

- Based on consultation with the state and federal agencies, anti-perching devices may be required on structures located within 0.5 mile of the center of an active sage grouse lek identified by previous field surveys.

- Upon determination of the proposed route, clearance surveys will identify active raptor nests along the transmission line route. If construction activities were to occur adjacent to an active nest site during the specific breeding and nesting season for that species, construction will be located a minimum of 0.5 mile from the nest during that species' breeding period. The WGFD, BLM, and USFWS will be contacted prior to construction to determine if an additional buffer area will be required, depending on species occupying the active nest site.

- Upon review of construction placement and extent of disturbance, construction activities will be curtailed from November 15 to March 1 within designated crucial winter range for both mule deer and pronghorn to minimize displacement and prevent adverse effects to wintering individuals.

- Project construction will be curtailed from May 1 through June 30 within designated pronghorn fawning areas to prevent disturbance to female pronghorns.

- Line stringing activities, including line pulling, will be prohibited within the pronghorn migrational corridors during spring or fall migration periods.

- Because pronghorn are more dispersed during the spring migration and inclement weather would prohibit line construction during a potentially critical period for the animals, construction may commence within the northern migration corridor during the spring season (April 1 to June 15). However, project construction will be curtailed from November 1 through December 15 within these migrational corridors intersected by the route.

- Upon determination of the proposed route, active prairie dog colonies will be mapped within 0.5 mile of the proposed ROW border. The USFWS will be contacted to determine the extent of black-footed ferret clearance surveys for identified white-tailed prairie dog colonies or complexes greater than 200 acres in size. If colony complexes total less than 200 acres, no clearance surveys will be required; however, if complexes exceed 1,000 acres, the USFWS and WGFD will be notified, as required under the 1990 revised Black-Footed Ferret Survey Guidelines, to further evaluate the area for possible ferret relocation. Clearance surveys, if required, will be conducted prior to construction initiation.

4.14.7 Aquatic Ecology

- Construction activities will be conducted so as to not unnecessarily destabilize stream banks. Disturbed banks will be stabilized with large angular rock riprap (at least 2 feet in one dimension). Hard, durable rock (e.g., granite) will be used, if possible.

- Construction activities will avoid riparian zones and its associated vegetation. Any riparian canopy or bank stabilizing vegetation removed as a result of construction activities will be reintroduced during project reclamation and protected from grazing until well established.

4.14.8 Land Use

No additional mitigation measures were deemed to be necessary for land use and zoning. Western will comply with all BLM ROW requirements and restrictions.

4.14.9 Recreation

No additional mitigation measures were deemed to be necessary for recreation resources.

4.14.10 Visual

- The primary mitigating measure for visual impacts due to the new transmission line focuses on reducing visual contrast. Conductors would have a dulled, non-reflective finish. Insulators would be a dark shade of a neutral color such as brown or gray. Any steel transmission structures would have a dull, non-reflective finish.

4.14.11 Cultural Resources

Western will conduct a Class III inventory of unsurveyed lands within the selected ROW and access easements prior to construction to evaluate the effects of the project on cultural resources. The significance of all sites located during the inventory would be evaluated against the criteria for listing on the National Register (36CFR60.4). This would include assessing visual impacts to historic sites, particularly those with standing structures. Mitigation plans would be developed in consultation with the Wyoming SHPO and other affected parties to guide the treatment of all historic properties that would be impacted by the project. Avoidance of impacts is the preferred form of mitigation. Where avoidance is not possible, data recovery would be undertaken. If previously undetected cultural resources are located during construction, work in the immediate vicinity of the find would cease until it could be evaluated by Western and, if necessary, impacts to the find be mitigated.

4.14.12 Socioeconomics

No additional mitigation measures were deemed to be necessary for socioeconomics.

4.14.13 Transportation

- Traffic delays on Highway 120 would be minimized during peak tourism periods.

4.15 Electrical Characteristics

Potential electrical effects associated with transmission lines include ozone generation, radio and television interference, audible noise, electric and magnetic field interference, and safety concerns. The first three of these potential effects are caused by corona, which is the electrical breakdown of air into charged particles created by the electrical field at the surface of the conductors.

Corona effects are generally associated with transmission lines operating at voltages of 345-kV or above. For the proposed action (built to 230-kV), corona effects would be negligible; ozone generation would be undetectable; and radio and television interference is not expected to be a problem. However, mitigative techniques do exist, and, if any problem occurred, Western would take corrective action. Noise may be noticeable directly under a line during foul weather. However, line noise would remain very low and would probably be masked by background storm noise during inclement weather. Audible noise (AN) is not expected to be an annoyance.

The proposed lines would be designed and constructed to meet or exceed all applicable requirements of the NESC. Western will correct any induced shocks on fences or buildings associated with the line. However, persons working near the lines should exercise caution not to contact the conductors with long, metallic objects (e.g., irrigation pipe). Such contact would produce a lethal electric shock.

Much attention has focused recently on reports of health effects associated with electric and magnetic fields. The evidence, however, has not established a cause and effect relationship. Magnetic field strengths drop rapidly as distance increases from the right-of-way. The Carter Mountain - Thermopolis transmission line crosses remote, unpopulated areas. Only one residence occurs within 0.25 mile of the line. Therefore, electric and magnetic field effects are

not expected to be a health concern. For more detail regarding electrical characteristics, refer to Appendix C.

4.16 No Action Alternative

Under the No Action Alternative, no new transmission lines would be built in the project area. The existing 69-kV transmission line would continue to operate with poles and structure components being replaced as necessary.

The primary advantage of this alternative is that no new investment would be made. Additional environmental studies, design summaries, etc., would not be required. However, implementation of this alternative would result in unacceptable voltage levels during single contingency outages. There would be no backup service for Tri-State's existing 115-kV Thermopolis Hamilton Dome-Carter Mountain Line. The voltage problems at Tri-State's Carter Mountain Substation would continue under first contingency condition. Furthermore, Western would not have the capability to transmit all of the generation at Yellowtail on the west side of the East-West ties.

The existing 69-kV transmission line would continue to be susceptible to numerous outages caused by lightning strikes and the structures would continue to deteriorate. The line's deteriorated condition may cause structural failures and unwarranted hazards to Western's maintenance crews and the general public. As structures became a hazard or failed, they would be replaced by maintenance crews on an as needed basis.

4.17 Cumulative Impacts

There are no other proposed transmission line projects in the study area that could result in cumulative impacts. By constructing the proposed line to 230-kV standards, initially energizing it at 115 kV, and then energizing it at 230 kV at some future date when required for increased transfer capacity, the need to build an additional line will be avoided. This will reduce future and overall cumulative impacts.

4.18 Long-Term Effects

The long-term effects associated with the physical presence of the proposed transmission line would include loss of cropland production or rangeland for grazing around the structure bases, and a potential increase in sage grouse predation from raptors using adjacent transmission line structures as perch sites. The long-term effect on cropland and rangeland would be minimal and not significant. The potential long-term effects to wildlife would be minimized through implementation of the mitigation measures described in Section 4.14.6 and would not be significant. These long-term effects would continue until the proposed project is no longer needed and the transmission structures are removed. Following abandonment and removal of the transmission line, any areas leveled for equipment required to dismantle the line would be regraded as near as feasible to their original condition. Similarly, areas where vegetation is disturbed during the dismantling process would be regraded and reseeded to prevent erosion.

5.0 LIST OF PREPARERS FOR THE CARTER MOUNTAIN-THERMOPOLIS

5.0 LIST OF PREPARERS FOR THE CARTER MOUNTAIN-THERMOPOLIS 230-kV TRANSMISSION LINE ENVIRONMENTAL ASSESSMENT

Name	Education/Experience	EA Responsibility
WESTERN AREA POWER ADMINISTRATION		
Fred Weiss	B.S. (Electrical Engineering) University of North Dakota 31 Years Professional Experience	Engineering Coordination
Alan Mertens	B.S. (Mechanical Engineering) University of Wyoming 10 Years Professional Experience	Project Engineer
Rodney Jones	M.S.E. (Environmental Engineering) The Johns Hopkins University B.A. (Biology) University of Delaware 20 Years Professional Experience	Project management, coordination, review, and environmental compliance
Bill Melander	B.S. (Wildlife Management) Utah State University 36 Years Professional Experience	Environmental Compliance
Jim Hartman	M.S. (Zoology) University of Michigan B.S. (Zoology) University of Wisconsin at Madison 14 Years Professional Experience	Review and Coordination
J.F. SATO AND ASSOCIATES		
Steve Miller	M.A. (Economics) University of Kansas B.A. (Economics) William Jewell College 16 Years Professional Experience	Project management, coordination, and review
Ben Phillips	M.A. (Public Administration) University of New Mexico B.S. (Archaeology) University of New Mexico Bachelor of Music Education, Eastern New Mexico University 15 Years Professional Experience	Cultural resources review
Germaine Reyes French	B.S. (Zoology) Colorado State University 16 Years Professional Experience	Project management, coordination, and review
ENSR		
Andrew Ludwig Project Manager	M.S. (Resource Planning & Conservation) University of Michigan) M.S. (Zoology) University of Michigan B.S. (Zoology) University of Michigan 14 Years Professional Experience	Project management, coordination of technical studies, EA preparation, quality review
Bill Theisen Project Coordinator	M.S. (Recreation Resources) Colorado State University B.S. (Natural Resources) University of Michigan 9 Years Professional Experience	Project coordination and EA preparation

Name	Education/Experience	EA Responsibility
Lori Nielsen	B.S. (Wildlife Management) Oklahoma State University 6 Years Professional Experience	Wildlife, aquatic ecology, water resources, floodplains, and wetlands
Jim Nyenhuis	M.S. (Soil Science) Candidate Michigan State University M.A. (Communication Research) Michigan State University 14 Years Professional Experience	Paleontology, geology, vegetation, and soils
Bernhard Strom	M.C.R.P. (City and Regional Planning) Harvard University B.S. (Urban Planning) Iowa State University 17 Years Professional Experience	Land use, recreation, visual, socioeconomics, and transportation
Bob Hammer	M.S. (Meteorology) South Dakota School of Mines and Technology B.S. (Meteorology) Metropolitan State College 8 Years Professional Experience	Air quality and climate
<u>CENTENNIAL ARCHAEOLOGY, INC.</u>		
Chris Zier	Ph.D. (Anthropology) University of Colorado M.A. (Anthropology) University of Colorado B.A. (Anthropology) University of Colorado 12 Years Professional Experience	Cultural resources
Andrea Barnes	B.A. (Southwest Studies) Fort Lewis College 10 Years Professional Experience	Cultural resources

6.0 CONSULTATION AND COORDINATION

During preparation of the EA, the following agencies and private organizations were contacted to obtain data:

<u>Federal</u>

Bureau of Land Management - Worland District Office - Grass Creek Resource Area - Worland, WY
Federal Emergency Management Agency
Fish and Wildlife Service - Cheyenne, WY
Soil Conservation Service - Thermopolis, WY
U.S. Geological Survey - Cheyenne, WY

<u>State</u>

Wyoming Department of Employment - Research and Analysis Section
Wyoming Department of Environmental Quality
Wyoming Department of Highways
Wyoming Department of Revenue and Taxation
Wyoming Game and Fish Department - Cheyenne, WY; Cody, WY; Lander, WY; and Thermopolis, WY
Wyoming Land Use Commission

<u>County and Local</u>

Hot Springs County - County Planner and Deputy County Attorney

<u>Private and Other</u>

National Wildlife Federation - Director of Institute for Wildlife Research
Rocky Mountain Heritage Task Force

<u>Public Meetings</u>

During preparation of the EA, the following public scoping meetings were conducted to inform the public about the project and to solicit input:

- Public meeting at the Holiday Inn in Thermopolis, Wyoming - April 3, 1990.

  Purpose: To describe the project, purpose and need, preliminary environmental concerns, EA preparation, route evaluation and selection process, the NEPA process, schedule, and to solicit input from the public.

- Public meeting in Thermopolis, Wyoming - September 12, 1990.

  Purpose: To describe the project, including purpose and need, the route selection process, Western's proposed route, the NEPA process, and the project schedule.

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LIST OF ABBREVIATIONS AND ACRONYMS

AIRFA - American Indian Religious Freedom Act
AN - audible noise
BLM - Bureau of Land Management
CB - citizen's band
CFR - Code of Federal Regulations
cfs - cubic feet per second
dBA - decibels-A-weighted
dBuV/m - decibels above 1 microvolt per meter
DOE - U.S. Department of Energy
EA - Environmental Assessment
FAA - Federal Aviation Administration
FM - frequency modulation
GCRA - Grass Creek Resource Area
Hz - hertz
kV - kilovolt
kV/m - kilovolts/meter
mA - milliamperes
NEPA - National Environmental Policy Act of 1969
NESC - National Electrical Safety Code
NRHP - National Register of Historic Places
ORV - off-road vehicle
ppb - parts per billion
RI - radio interference
ROW - right-of-way
SCS - Soil Conservation Service
TSP - Total Suspended Particulate
TVI - television interference
g/m^3 - microgram/cubic meter
USFWS - U.S. Fish and Wildlife Service
USGS - U.S. Geological Survey
V/m - volts/meter
VRI - Visual Resource Inventory
VRM - Visual Resource Management
WGFD - Wyoming Game and Fish Department
WNDD - Wyoming Natural Diversity Database

APPENDIX A

ALTERNATE ROUTE CONSIDERATIONS

TABLE A-1

Alternative Routes Considered

Route A (Links)	Route B (Links)	Route C (Links)	Route D (Links)	Route E (Links)	Route F (Links)
1	9	18	1	1	1
2	11	21	2	2	2
3a	13	23	19	3a	3a
3c	15	25	21	3c	3c
3d	16		23	3d	3d
4	28		25	22	4
5	8			23	24
6				25	26
7					25
8					

Route G (Links)	Route H (Links)	Route I (Links)	Route J (Links)	Route K (Links)	Route L (Links)
1	9	1	1	1	1
2	10	20	2	20	20
3a	3a	3a	3a	3a	3a
3c	3c	3c	3c	3c	3b
3d	3d	3d	3d	3d	3d
4	4	4	4	4	4
5	5	5	5	24	24
16	16	16	6	26	27
28	28	28	17	25	28
8	8	8			8

TABLE A-2

SUMMARY OF ALTERNATIVE ROUTES

ROUTE	TOTAL LINK LENGTH	EXISTING WESTERN ROW(1)	PARALLEL TO EXISTING LINE(2)	NEW ROW REQUIRED(3)	FEDERAL LAND CROSSED	STATE LAND CROSSED	PRIVATE LAND CROSSED	RESIDENCES WITHIN 1/4 MILE	RECREATION FEATURES CROSSED(4)	HISTORIC FEATURES CROSSED(4)	SENSITIVE SCENIC AREAS CROSSED(5)	INCOMPATIBLE FEATURES CROSSED(6)	SAGE GROUSE PRODUCTION AREAS CROSSED	CRUCIAL WINTER RANGE CROSSED(7)	PRONGHORN FAWNING AREAS CROSSED	PRONGHORN MIGRATION ROUTES CROSSED
	(MILES)	(MILES)	(MILES)	(MILES)	(MILES)	(MILES)	(MILES)	(NUMBER)	(NUMBER)	(NUMBER)	(MILES)	(NUMBER)	(MILES)	(MILES)	(MILES)	(MILES)
ROUTE A	41.47	40.84	16.46	0.63	21.31	0.00	20.16	7.00	0.00	7.00	4.65	0.00	14.67	23.91	0.06	11.84
ROUTE B	42.93	0.00	41.58	1.35	30.70	3.03	10.18	2.00	0.90	1.00	3.39	0.00	8.27	25.11	0.00	11.19
ROUTE C	44.14	0.00	35.62	8.52	30.12	3.59	10.43	1.00	0.00	6.00	3.31	0.00	19.64	12.70	8.83	17.51
ROUTE D	42.14	6.36	30.89	6.94	27.38	3.31	11.45	1.00	0.00	8.00	3.31	0.00	16.72	19.96	4.18	11.84
ROUTE E	41.04	15.67	30.86	1.50	26.37	2.52	12.15	1.00	0.00	7.00	3.31	0.00	10.41	23.56	2.76	11.84
ROUTE F	40.38	22.10	30.90	0.80	25.09	2.52	12.77	1.00	0.96	7.00	3.31	0.00	10.17	23.91	0.00	11.84
ROUTE G	41.91	25.54	32.04	0.79	26.26	1.96	14.67	2.00	0.00	6.00	3.39	0.00	10.17	23.99	0.00	11.84
ROUTE H	43.18	19.18	37.40	1.01	29.08	3.03	11.25	1.00	0.00	2.00	3.39	0.00	19.17	25.26	0.00	11.26
ROUTE I	42.95	21.23	37.39	0.79	29.04	3.07	11.82	1.00	0.00	4.00	3.39	0.00	10.25	25.03	0.00	11.10
ROUTE J	41.31	38.63	16.46	2.68	20.76	0.00	20.55	7.00	0.00	8.00	4.49	0.00	14.66	23.91	0.00	11.84
ROUTE K	41.42	17.79	36.25	0.80	27.87	3.63	9.92	0.00	0.60	5.00	3.31	0.00	10.25	24.95	0.00	11.10
ROUTE L	41.45	13.42	40.13	1.32	28.25	2.57	10.63	1.00	0.00	4.00	3.39	0.00	9.39	24.79	0.00	11.10

FOOTNOTES:

(1) Miles of a proposed link using Western's existing 69-kV transmission line ROW.
(2) Miles of a proposed link parallel to an existing transmission line.
(3) Miles of a proposed link not parallel to an existing transmission line and not using Western's existing 69-kV transmission line ROW.
(4) Recreational, historical, archaeological, paleontological, or other culturally significant areas.
(5) Miles of a proposed link crossing a Visual Resource Management Class II area.
(6) Incompatible features include landing strips, oil wells, or communication systems that would result in interference if crossed by a proposed link.
(7) Miles of crucial winter range for mule deer and pronghorn.

TABLE A-2 (CONTINUED)

ROUTE	RAPTOR NEST SITES WITHIN 0.5 MILE	IMPROVED WILDLIFE PONDS CROSSED(8)	DESIGNATED WILD HORSE AREAS CROSSED	RIPARIAN/ WETLAND AREAS CROSSED	FLOOD-PLAINS CROSSED	PERENNIAL STREAM CROSSINGS	SENSITIVE PLANT HABITAT CROSSED(9)	RANGELAND CROSSED	CROPLAND CROSSED(10)	PRIME FARMLAND CROSSED(11)	EROSIVE SOILS CROSSED(12)	MODERATE SLOPES CROSSED(13)	EXCESSIVE SLOPES CROSSED(14)	EXISTING ROAD ACCESS(15)	NEW ACCESS ROADS REQUIRED(15)	CROSSOVERS OF OTHER LINES REQUIRED	SPECIAL STRUCTURES REQUIRED(17)
	(NUMBER)	(NUMBER)	(MILES)	(MILES)	(MILES)	(NUMBER)	(MILES)	(MILES)	(MILES)	(MILES)	(MILES)	(MILES)	(MILES)	(MILES)	(MILES)	(NUMBER)	(NUMBER)
ROUTE A	3.00	8.00	0.00	0.86	3.06	4.00	0.00	39.46	1.15	0.97	0.53	1.66	0.53	37.87	0.25	3.00	21.00
ROUTE B	3.00	3.00	0.00	0.66	1.70	4.00	0.00	41.99	0.20	0.91	0.90	2.04	0.90	20.47	4.00	2.00	24.00
ROUTE C	4.00	2.00	0.00	0.52	2.24	4.00	1.76	43.44	0.18	0.14	1.21	2.76	1.21	11.26	6.56	4.00	21.00
ROUTE D	4.00	3.00	0.00	0.64	1.88	4.00	0.00	41.18	0.32	0.14	1.21	2.02	1.21	14.34	8.50	4.00	16.00
ROUTE E	4.00	4.00	0.00	0.72	2.20	4.00	0.00	40.00	0.32	0.14	0.96	1.67	0.95	20.65	4.00	4.00	16.00
ROUTE F	2.00	5.00	0.00	0.64	2.04	4.00	0.00	39.42	0.32	0.14	0.98	1.60	0.98	23.60	3.28	4.00	15.00
ROUTE G	3.00	5.00	0.00	0.60	2.04	4.00	0.00	40.89	0.42	0.11	0.94	1.74	0.94	30.08	1.75	3.00	17.00
ROUTE H	2.00	4.00	0.00	0.54	1.84	4.00	0.00	42.36	0.20	0.11	0.80	1.95	0.80	28.89	2.25	4.00	19.00
ROUTE I	2.00	6.00	0.00	0.65	1.84	4.00	0.00	42.01	0.20	0.11	0.83	1.91	0.83	29.04	2.25	3.00	19.00
ROUTE J	3.00	7.00	0.00	0.86	3.06	4.00	0.00	39.30	1.15	0.97	0.41	1.41	0.41	37.23	0.66	2.00	18.00
ROUTE K	1.00	6.00	0.00	0.79	1.84	4.00	0.00	40.54	0.18	0.14	0.87	1.57	0.87	22.56	3.78	6.00	17.00
ROUTE L	2.00	4.00	0.00	0.66	1.84	4.00	0.00	40.51	0.20	0.11	1.01	2.11	1.01	27.45	4.57	3.00	20.00

FOOTNOTES:

(8) Water resources improved for wildlife use.
(9) Miles of potential habitat crossed for a plant of Special Concern, Cymopterus evertii, (Evert's Waferparsnip).
(10) Cropland was measured off 1:58,000-scale color infrared aerial photographs.
(11) Those areas where the soil meets the requirements for prime farmland, as defined by the USDA Soil Conservation Service (SCS). Source: measured off unpublished soil survey for Hot Springs County.
(12) Primarily those soils subject to wind or water erosion based on SCS criteria.
(13) Slopes of 15 to 30 percent.
(14) Slopes greater than 30 percent.
(15) Along an existing state, county, or other local road.
(16) That segment of a proposed link not accessible from an existing road.
(17) Includes small angle, medium angle, heavy angle, dead end, and special transmission line structures.

TABLE A-3

RANK ORDER OF ENVIRONMENTAL FACTORS

ROUTE	TOTAL LINK LENGTH (MILES)	EXISTING WESTERN ROW(1) (MILES)	PARALLEL TO EXISTING LINE(2) (MILES)	NEW ROW REQUIRED(3) (MILES)	FEDERAL LAND CROSSED (MILES)	STATE LAND CROSSED (MILES)	PRIVATE LAND CROSSED (MILES)	RESIDENCES WITHIN 1/4 MILE (NUMBER)	RECREATION FEATURES CROSSED(4) (NUMBER)	HISTORIC FEATURES CROSSED(4) (NUMBER)	SENSITIVE SCENIC AREAS CROSSED(5) (MILES)	INCOMPATIBLE FEATURES CROSSED(6) (NUMBER)	SAGE GROUSE PRODUCTION AREAS CROSSED (MILES)	CRUCIAL WINTER RANGE CROSSED(7) (MILES)	PRONGHORN FAWNING AREAS CROSSED (MILES)	PRONGHORN MIGRATION ROUTES CROSSED (MILES)
ROUTE A	41.47(6)	40.04(1)	16.46(11)	0.63(1)	21.31(11)	0.00(9)	20.16(11)	7.00(4)	0.00(1)	7.00(6)	4.65(4)	0.00(1)	14.67(7)	23.91(4)	0.00(1)	11.04(4)
ROUTE B	42.93(9)	0.00(11)	41.50(1)	1.35(6)	30.70(1)	3.03(5)	10.18(2)	2.00(3)	0.00(1)	1.00(1)	3.37(2)	0.00(1)	8.27(1)	25.11(9)	0.00(1)	11.17(2)
ROUTE C	44.14(12)	0.00(11)	35.62(6)	0.52(10)	30.12(2)	3.59(2)	10.43(3)	1.00(2)	0.00(1)	6.00(5)	3.31(1)	0.00(1)	19.64(9)	12.70(1)	8.03(4)	17.51(5)
ROUTE D	42.14(8)	6.36(10)	30.09(9)	6.94(9)	27.38(7)	3.31(3)	11.45(6)	1.00(2)	0.00(1)	8.00(7)	3.31(1)	0.00(1)	16.72(8)	17.96(2)	4.10(3)	11.84(4)
ROUTE E	41.04(2)	15.67(8)	30.86(10)	1.50(7)	26.37(8)	2.52(7)	12.15(8)	1.00(2)	0.00(1)	7.00(6)	3.31(1)	0.00(1)	10.41(5)	23.56(3)	2.71(2)	11.04(4)
ROUTE F	40.38(1)	22.10(4)	30.90(8)	0.80(3)	25.09(10)	2.52(7)	12.77(9)	1.00(2)	0.00(1)	7.00(6)	3.31(1)	0.00(1)	10.17(3)	23.91(4)	0.00(1)	11.84(4)
ROUTE G	41.91(7)	25.54(3)	32.04(7)	0.79(2)	26.26(9)	1.96(8)	14.67(10)	2.00(3)	0.00(1)	6.00(5)	3.39(2)	0.00(1)	10.17(3)	23.99(5)	0.00(1)	11.04(4)
ROUTE H	43.10(11)	19.18(6)	37.40(3)	1.01(4)	29.08(3)	3.03(5)	11.25(5)	1.00(2)	0.00(1)	2.00(2)	3.39(2)	0.00(1)	10.17(3)	25.26(10)	0.00(1)	11.26(3)
ROUTE I	42.95(10)	21.23(5)	37.39(4)	0.79(2)	29.04(4)	3.07(4)	11.82(7)	1.00(2)	0.00(1)	4.00(3)	3.39(2)	0.00(1)	10.25(4)	25.03(8)	0.00(1)	11.10(1)
ROUTE J	41.31(3)	30.63(2)	16.46(11)	2.60(8)	20.76(12)	0.00(9)	20.55(12)	7.00(4)	0.00(1)	8.00(7)	4.49(3)	0.00(1)	14.66(6)	23.91(4)	0.00(1)	11.84(4)
ROUTE K	41.42(4)	17.79(7)	36.25(5)	0.80(3)	27.87(6)	3.63(1)	9.92(1)	0.00(1)	0.00(1)	5.00(4)	3.31(1)	0.00(1)	10.25(4)	24.95(7)	0.00(1)	11.10(1)
ROUTE L	41.45(5)	13.42(9)	40.13(2)	1.32(5)	28.25(5)	2.57(6)	10.63(4)	1.00(2)	0.00(1)	4.00(3)	3.39(2)	0.00(1)	9.39(2)	24.79(6)	0.00(1)	11.10(1)

FOOTNOTES:

(1) Miles of a proposed link using Western's existing 69-kV transmission line ROW.
(2) Miles of a proposed link parallel to an existing transmission line.
(3) Miles of a proposed link not parallel to an existing transmission line and not using Western's existing 69-kV transmission line ROW.
(4) Recreational, historical, archaeological, paleontological, or other culturally significant areas.
(5) Miles of a proposed link crossing a Visual Resource Management Class II area.
(6) Incompatible features include landing strips, oil wells, or communication systems that would result in interference if crossed by a proposed link.
(7) Miles of crucial winter range for mule deer and pronghorn.

TABLE A-3 (CONTINUED)

ROUTE	RAPTOR NEST SITES WITHIN 0.5 MILE	IMPROVED WILDLIFE PONDS CROSSED(8)	DESIGNATED WILD HORSE AREAS CROSSED	RIPARIAN/ WETLAND AREAS CROSSED	FLOOD-PLAINS CROSSED	PERENNIAL STREAM CROSSINGS	SENSITIVE PLANT HABITAT CROSSED(9)	RANGELAND CROSSED	CROPLAND CROSSED(10)	PRIME FARMLAND CROSSED(11)	EROSIVE SOILS CROSSED(12)	MODERATE SLOPES CROSSED(13)	EXCESSIVE SLOPES CROSSED(14)	EXISTING ROAD ACCESS(15)	NEW ACCESS ROADS REQUIRED(16)	CROSSOVERS OF OTHER LINES REQUIRED	SPECIAL STRUCTURES REQUIRED(17)
	(NUMBER)	(NUMBER)	(MILES)	(MILES)	(MILES)	(NUMBER)	(MILES)	(MILES)	(MILES)	(MILES)	(MILES)	(MILES)	(MILES)	(MILES)	(MILES)	(NUMBER)	(NUMBER)
ROUTE A	3.00(3)	0.00(12)	0.00(1)	0.86(8)	3.06(7)	4.00(1)	0.00(1)	39.46(10)	1.15(5)	0.97(4)	0.53(2)	1.66(4)	0.53(2)	37.07(1)	0.25(2)	3.00(2)	21.00(6)
ROUTE B	3.00(3)	3.00(2)	0.00(1)	0.66(5)	1.70(1)	4.00(1)	0.00(1)	41.99(4)	0.28(2)	0.91(3)	0.90(6)	2.04(10)	0.90(6)	20.47(10)	4.00(7)	2.00(1)	24.00(7)
ROUTE C	4.00(4)	2.00(1)	0.00(1)	0.52(1)	2.24(6)	4.00(1)	1.76(2)	43.44(1)	0.18(1)	0.14(2)	1.21(11)	2.76(12)	1.21(11)	11.26(12)	6.56(9)	4.00(3)	21.00(6)
ROUTE D	4.00(4)	3.00(2)	0.00(1)	0.64(4)	1.88(3)	4.00(1)	0.00(1)	41.18(5)	0.32(3)	0.14(2)	1.21(11)	2.02(9)	1.21(11)	14.34(11)	8.50(10)	4.00(3)	16.00(2)
ROUTE E	4.00(4)	4.00(3)	0.00(1)	0.72(7)	2.20(5)	4.00(1)	0.00(1)	40.00(9)	0.32(3)	0.14(2)	0.96(8)	1.67(5)	0.95(8)	20.65(9)	4.00(7)	4.00(3)	16.00(2)
ROUTE F	2.00(2)	5.00(4)	0.00(1)	0.64(4)	2.04(4)	4.00(1)	0.00(1)	39.42(11)	0.32(3)	0.14(2)	0.98(9)	1.60(3)	0.98(9)	23.60(7)	3.20(5)	4.00(3)	15.00(1)
ROUTE G	3.00(3)	5.00(4)	0.00(1)	0.60(3)	2.04(4)	4.00(1)	0.00(1)	40.89(6)	0.42(4)	0.11(1)	0.94(7)	1.94(7)	0.94(7)	30.08(3)	1.75(3)	3.90(2)	17.00(3)
ROUTE H	2.00(2)	4.00(3)	0.00(1)	0.54(2)	1.84(2)	4.00(1)	0.00(1)	42.36(2)	0.28(2)	0.11(1)	0.80(3)	1.95(8)	0.80(3)	28.89(5)	2.25(4)	4.00(3)	19.00(5)
ROUTE I	2.00(2)	6.00(5)	0.00(1)	0.65(5)	1.84(2)	4.00(1)	0.00(1)	42.01(3)	0.28(2)	0.11(1)	0.83(4)	1.91(6)	0.83(4)	29.04(4)	2.25(4)	3.00(2)	19.00(5)
ROUTE J	3.00(3)	7.00(6)	0.00(1)	0.86(8)	3.06(7)	4.00(1)	0.00(1)	39.30(12)	1.15(5)	0.97(4)	0.41(1)	1.41(1)	0.41(1)	37.23(2)	0.00(1)	2.00(1)	18.00(4)
ROUTE K	1.00(1)	6.00(5)	0.00(1)	0.79(6)	1.84(2)	4.00(1)	0.00(1)	40.54(7)	0.18(1)	0.14(2)	0.87(5)	1.57(2)	0.87(5)	22.56(8)	3.78(6)	4.00(3)	17.00(3)
ROUTE L	2.00(2)	4.00(3)	0.00(1)	0.66(5)	1.84(2)	4.00(1)	0.00(1)	40.51(8)	0.28(2)	0.11(1)	1.01(10)	2.11(11)	1.01(10)	27.45(6)	4.57(8)	3.00(2)	24.00(7)

FOOTNOTES:

(8) Water resources improved for wildlife use.
(9) Miles of potential habitat crossed for a plant of Special Concern, *Cymopterus evertii*, (Evert's Waferparsnip).
(10) Cropland was measured off 1:50,000-scale color infrared aerial photographs.
(11) Those areas where the soil meets the requirements for prime farmland, as defined by the USDA Soil Conservation Service (SCS). Source: measured off unpublished soil survey for Hot Springs County.
(12) Primarily those soils subject to wind or water erosion based on SCS criteria.
(13) Slopes of 15 to 30 percent.
(14) Slopes greater than 30 percent.
(15) Along an existing state, county, or other local road.
(16) That segment of a proposed link not accessible from an existing road.
(17) Includes small angle, medium angle, heavy angle, dead end, and special transmission line structures.

APPENDIX B

BIOLOGICAL ASSESSMENT FOR THE CARTER MOUNTAIN-THERMOPOLIS 230-kV TRANSMISSION LINE ENVIRONMENTAL ASSESSMENT

July 1991

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1.0 INTRODUCTION

Federal agencies, in consultation with the U.S. Fish and Wildlife Service (USFWS), are required to ensure that any action they authorize, fund, or carry out will not adversely affect a federally listed threatened or endangered species. A biological assessment is required if Federal actions of major construction activities potentially jeopardize the continued existence of any federally listed species or results in the destruction or adverse modification of its critical habitat. This biological assessment is presented to facilitate the project's compliance with Section 7(a)(2) of the Endangered Species Act (ESA) of 1973.

Western Area Power Administration (Western), of the U.S. Department of Energy, is the Federal agency responsible for the preparation of the biological assessment for the proposed Carter Mountain-Thermopolis 230-kV Transmission Line. Western will determine either a "no affect" or "may affect" conclusion for threatened or endangered species based on this assessment. A "may affect" decision would initiate a request for formal consultation with the USFWS under Section 7(a) of the Endangered Species Act. The USFWS would then prepare a Biological Opinion on the projected effects of the project on threatened or endangered species, if further consultations are required.

A biological assessment is required for the Carter MountainThermopolis 230-kV Transmission Line Project because three federally-endangered species may occur within the study area, based on range, habitat requirements, and historical occurrence. The endangered species include the black-footed ferret, bald eagle, and peregrine falcon. These sensitive species could be adversely affected by construction and operation of the transmission line. The bald eagle and peregrine falcon assessments were prepared from existing data and interviews with local biologists.

The baseline information for the black-footed ferret has been completed. However, the assessments for this species cannot be finalized until mapping of active prairie dog colonies along the preferred route have been completed. The USFWS will be contacted to determine if black-footed ferret clearance surveys will be required for identified colonies. If clearance surveys are required, they will be conducted prior to construction initiation, according to USFWS guidelines for ferret surveys.

2.0 ENDANGERED SPECIES EVALUATIONS

2.1 Black-Footed Ferret

2.1.1 Status

The black-footed ferret (Mustela nigripes) is federally-listed as endangered, is a member of the mustelid or weasel family, and is the only ferret native to North America (Hall 1981). The black-footed ferret is seldom seen because of its secretive nature and nocturnal habits (Hillman and Carpenter 1983; Fortenbery 1972).

Many authorities considered the black-footed ferret extinct by the middle of this century, until it was observed in Mellette County, South Dakota in August 1964. This discovery instigated 11 years of ferret studies, indicating a highly dispersed, low density population distributed within a minimum of 8 counties (Hillman 1968; Henderson et al. 1969; Sheets 1970; Linder et al. 1972; Fortenbery 1972). The population disappeared by 1974 and only scattered reports of individuals persisted until 1981, when another viable population was discovered in northwest Wyoming near Meeteetse (USFWS 1988). These animals comprised the only known wild population of the black-footed ferret in existence.

Population estimates at Meeteetse were approximately 129 ferrets (43 adults and 86 juveniles) during the summer of 1984 (USFWS 1988). However, the population subsequently declined to roughly 65 known animals during the winter of 1984-1985, and with the outbreak of canine distemper in the colony during the summer of 1985, the colony declined further to only a few remaining individuals. In an attempt to save the black-footed ferret from possible extinction, 6 animals were captured during the fall of 1985, 11 animals were captured during the summer of 1986, and 1 additional male was taken in February 1987 (USFWS 1988; Morkill et al. 1987). These 18 animals (7 males and 11 females) provided the basis for a captive breeding program.

As a result of this program, a total of 118 adult ferrets existed in captivity prior to the 1990 breeding season: 48 males and 40 females were located at the Sybille Wildlife Research and Conservation Unit in Wyoming, 5 males and 5 females resided at the National Zoological Park Conservation and Research Center in Virginia, and 11 males and 11 females were reported at the Henry Doorly Zoo in Nebraska (Thorne 1990). The Louisville Zoological Park in Kentucky is also scheduled to receive black-footed ferrets for its captive breeding program during the fall of 1990 (WGFD 1990). In addition to the existing 118 adult ferrets, as of June 11, 1990, a total of 49 kits were surviving at Sybille, 3 kits were located at the Front Royal, Virginia facility, and young were soon expected at the Henry Doorly Zoo in Omaha. These population numbers will fluctuate from the additional litters anticipated at the breeding facilities and from potential ferret mortality. The state and federal agencies involved in the captive breeding program are hopeful for a total of 200 black-footed ferrets by the end of the 1990 breeding season (Thorne 1990). The colony of wild ferrets near Meeteetse has since disappeared; no populations of black-footed ferrets are currently known to exist in the wild (USFWS 1988).

2.1.2 General Distribution

Historically, the range of the black-footed ferret coincided closely with that of the prairie dog (Cynomys spp.) throughout the Great Plains, semi-arid grasslands, and mountain basins of North America (Hillman 1968). The species is thought to have been distributed from southern Alberta and Saskatchewan, south to Arizona and Texas (Henderson et al. 1969). Although no recent specimens are known from Mexico, black-tailed prairie dog distributions from north-central Chihuahua (Lesueur 1945) and the location of Pleistocene ferret skeletal material in Chihuahua (Messing 1986) suggest that black-footed ferrets may have occurred there within recent history as well (USFWS 1988). No black-footed ferrets are currently known to occur outside of the captive populations; however, remnant ferret populations may exist in portions of its former range (Hillman and Carpenter 1980).

2.1.3 Life History and Habitat Requirements

Black-footed ferrets are primarily nocturnal, solitary carnivores that are nearly obligate associates of the prairie dog (Cynomys spp.). In addition to relying on prairie dogs as their primary prey source, ferrets may utilize the burrows to raise their young. Although ferrets are primarily nocturnal, they may also be active during daylight hours, particularly during the summer period (Henderson et al. 1969; Linder et al. 1972; Fortenbery 1972; Hillman 1968; Forrest et al. 1985).

Black-footed ferrets have been reported to breed from March to May (USFWS 1988). The gestation period ranges from 41 to 45 days, with as many as five young born in late May and early June. The kits remain underground until late June or early July. In early summer, the kits most often occupy one burrow; however, as the season progresses, the female may place the offspring in separate burrows scattered throughout the prairie dog colony. The kits may then accompany her during nocturnal foraging within the colony.

Ferrets are most commonly observed in late summer or early fall. Male ferrets are not active in rearing the young and live a solitary life except during the breeding season. A detailed discussion of the black-footed ferret's life history is presented in Hillman and Carpenter (1980).

2.1.4 Endangerment Factors

Control or extermination of prairie dogs has had an important influence on ferret endangerment (USFWS 1988). The ferret's present decline is related to the continued decrease in both prairie dog populations and the suitable habitat provided by their colonies. Prairie dog numbers and acres of occupied towns have been reduced drastically with the major land use changes and extensive poisoning campaigns aimed at eradicating the prairie dog from western rangelands (Linder et al. 1972; Clark 1978). Direct reduction in the areas occupied by prairie dogs has resulted in a decrease in the number of black-footed ferrets linearly (Forrest et al. 1985) and increases the distances between colonies, which in turn limits or eliminates opportunities for natural dispersal and recolonization of ferrets (USFWS 1988). Although prairie dogs still occupy much of their former range, their numbers are only a small fraction of those that occurred in the late 1800s. Various estimates suggest a reduction of 90 to 95 percent of historically occupied prairie dog habitat from the early 1900s to the present (Choate et al. 1982; Anderson et al. 1986; Flath and Clark 1986). Remaining prairie dog colonies appear to be smaller and often more isolated (USFWS 1988). The poisoning programs initiated by federal, state, and local agencies and various private groups have poisoned hundreds of thousands of acres throughout the west, dramatically reducing prairie dog populations and potentially reducing the number of black-footed ferrets as well (Clark 1978; Henderson et al. 1969; Smith 1967; Cottam and Caroline 1965).

Disease has been a significant influence on ferret population dynamics. Black-footed ferrets may be susceptible to a variety of diseases, including having no natural immunity to canine distemper (Carpenter et al. 1976). Canine distemper has impacted the ferret captive breeding programs and annihilated the Meeteetse population (USFWS 1988). Because the black-footed ferret is so critically sensitive to canine distemper and this disease is so ubiquitous in other wildlife species (Budd 1981; Williams 1982), ferret populations maintain a high probability of exposure to the disease, which will likely continue to affect wild ferret populations (USFWS 1988).

The number of animals necessary to maintain the biological diversity for a stable or increasing ferret population is currently unknown. Estimated population sizes for both captive and wild ferrets necessary to avoid extinction, based on the viability of the species, has differed. Therefore, a range of applicable management strategies for black-footed ferret recovery has been introduced (USFWS 1988).

2.1.5 Presence in the Study Area

The black-footed ferret historically inhabited the project vicinity of the proposed Carter Mountain-Thermopolis Transmission Line; however, no ferret populations are presently known to occur in the study area. White-tailed prairie dogs are common in the project area and may occupy colony complexes greater than 200 acres in size (Luce 1990); therefore, ferrets could potentially exist within the appropriate habitat.The WGFD has been involved in mapping prairie dog colonies throughout Wyoming, particularly in the areas of potential ferret sightings.

The WGFD received 65 reports of black-footed ferret sightings from mid-April 1988 to mid-March 1989; although, none of these were confirmed by WGFD personnel upon investigation. A substantial increase of reported sightings in 1988-1989 over the previous few years is attributed in part to the $5,000 reward offered by the New York Zoological Society through September 30, 1989 for information leading to the discovery of a ferret population (WGFD 1989).

A mapping survey for active prairie dog colonies will be conducted within 0.5 mile either side of the project ROW to ascertain current prairie dog colony locations and their size. The USFWS will be contacted to determine if black-footed ferret clearance surveys will be required for the identified colonies; surveys are typically required for colonies or complexes over 200 acres in size. Clearance surveys, if required, will be conducted prior to construction initiation, according to USFWS guidelines for ferret surveys (USFWS 1989).

2.1.6 Impact Evaluation

Because the black-footed ferret is so closely associated with prairie dog populations, all prairie dog colonies are considered to be potential habitat for this endangered species. In order to maintain ferret numbers, a stable prairie dog population incorporated with a sufficiently large colony or complex of colonies appear to be necessary (USFWS 1988). Disturbance of prairie dog colonies located within the transmission line ROW, as a result of line construction or maintenance, may significantly impact ferrets, if present within the project area. As stated in Mitigation Measures in Section 4.14 of the EA, all prairie dog colonies will be mapped along the proposed transmission line route; active colonies will be delineated; and clearance surveys within these active areas for black-footed ferrets will be conducted prior to construction initiation, if required by the USFWS (see Section 2.1.5). Clearance surveys will determine ferret presence in areas impacted by the route. Final impact assessment will subsequently follow the scheduled mapping and clearance surveys, prior to project construction.

2.1.7 References

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2.2 Bald Eagle

2.2.1 Status

The bald eagle (Haliaeetus leucocephalus) is federally-listed as endangered in 43 of the 48 conterminous United States. The species is federally listed as threatened within the states of Washington, Oregon, Minnesota, Wisconsin, and Michigan (USFWS 1989). Bald eagles are also protected under the Bald Eagle Protection Act of June 8, 1940, as amended and the Migratory Bird Treaty Act of July 3, 1918, as amended June 20, 1936 in all states, including Alaska.

An accurate population estimate for the bald eagle is difficult to establish, especially for remote regions of Alaska and Canada. The estimated world population in 1987 was approximately 80,000 eagles (Hastings 1989), with the majority occurring in Alaska and Canada. Individuals that typically breed in Alaska and Canada may migrate into and disperse throughout the lower 48 states during the winter period. Within these states, the 1989 mid-winter bald eagle survey estimated 11,610 eagles for the 43 states that participated in this annual count (LeFranc 1990). In 1987 and 1988, estimated eagle numbers in 40 states totaled 9,258 and 11,241, respectively (Hastings 1989). The 1989 estimate of the breeding population in the lower 48 states totaled 2,588 breeding pairs (LeFranc 1990); Alaska contained an estimated 7,500 breeding pairs in 1988 (Hastings 1989).

2.2.2 General Distribution

The bald eagle's breeding range formerly included most of the continent; the species historically nested in areas where suitable habitat occurred (USFWS 1986). Eagles nested throughout the Rocky Mountain region, including the wooded mountains and river woodland areas of Wyoming, Montana, and North Dakota. During the 19th and 20th centuries, the bald eagle breeding range diminished and the species disappeared from many parts of its range. However, in recent years, eagles have been returning to breed successfully at historic nest sites and have been establishing new territories. Bald eagles currently nest in Alaska, Canada, the Pacific Northwest, the central and northern Rocky Mountain states, the Great Lakes area, Florida, and Chesapeake Bay. The winter range includes most of the breeding range but extends predominantly southward from southern Alaska and southern Canada (USFWS 1986).

Most bald eagles that breed in the 48 conterminous states also winter there. Individuals nesting in northern states may migrate south in the winter to utilize the more open water areas and increased prey availability, while others may move relatively short distances to lower elevations or inland food sources (USFWS 1986). In addition, some eagles that nest in Alaska and Canada also migrate south to wintering areas within the lower 48 states. These movements begin during the post-fledging dispersal period and are usually triggered by freezing water in northern areas. The largest wintering eagle concentrations occur in the Klamath Basin, California; in the Midwestern states along the Mississippi, Missouri, Illinois, Platte, and Arkansas Rivers; and in the Northwest encompassing Washington, Oregon, Idaho, and western Montana. Major rivers and other open water bodies in Wyoming, Montana, and North Dakota also serve as wintering grounds for the bald eagle (Spencer 1976).

Both nesting and wintering bald eagles occur within the State of Wyoming. It has been estimated that the most severe declines in bald eagle numbers in Wyoming most likely occurred in the late 1800s and early 1900s, prior to historical documentation. Settlement along the major river systems and extensive poisoning and shooting of all predators were prevalent during this period and undoubtedly affected both resident and migratory eagle populations (USFWS 1986).

Forty-four nest territories have previously been documented, with a majority of these located in the northwestern portion of the state (USFWS 1986). In fact, bald eagles that nest in northwestern Wyoming contribute to a significant part of the nesting population in the Rocky Mountain West (WGFD 1989). Other nesting pairs occur in widely scattered areas of the state, including the Bighorn and Tongue Rivers in northern Wyoming and the North Platte River in southern Wyoming (USFWS 1986).

Wintering eagles are distributed throughout the state, with concentrations associated with the North Platte, Green, Snake, and Bighorn Rivers, in addition to the Woodruff Narrows (USFWS 1986). In 1989, mid-winter bald eagle surveys conducted in cooperation with the National Wildlife Federation examined 37 survey locations and reported 521 birds within 32 of those territories. The 1990 partial mid-winter count only surveyed 28 wintering locations and reported 109 individuals in 22 of the 28 territories (LeFranc 1990).

2.2.3 Life History and Habitat Requirements

The breeding season of the bald eagle varies with latitude. Bald eagles normally reach breeding age at about 5 years, which roughly coincides with full adult plumage (Hancock 1973). Pre-nesting activities occur as early as January, but typically take place in February or early March and include courtship flights, nest repair, and nest building. Egg laying and incubation usually begins in March, lasting 34 to 35 days. One to four eggs (average two) are laid (Brown and Amadon 1968). The period from hatching to fledging is about 10 to 13 weeks, with a post-fledging period of 3 to 10 weeks (Todd 1979).

Nests are usually located in multi-storied trees; optimum nesting habitat includes proximity to open water providing an adequate food source, large nest trees with sturdy branches at sufficient height, and stand heterogeneity. Good visibility from the nest and a clear flight path are essential (Grubb 1976). In Wyoming, 83 percent of the active bald eagle nests are located within 600 feet of water (Alt 1980). Eagles often use the same nest each year and will supplement with new nesting material or rebuild the nest, if destroyed. Consequently, nests may become very large and may be 2 to 3 feet deep and 5 feet in diameter (Grubb 1976; Anderson and Bruce 1980). Prey items during the nesting season consist primarily of fish (Grubb and Hansel 1978). Other food items include songbirds, invertebrates, small animals, and carrion.

Bald eagles migrate from breeding areas between September and December and generally winter as far north as open water and food are available. The major components of habitat on wintering grounds include a food source and suitable trees for diurnal perching and night roosting. Wintering eagles usually gather along lakes and major river systems, but may use arid valleys as well (Edwards 1969). Bald eagles may gather in large aggregations and share communal roosts, diurnal perches, and feeding areas. Eagles are attracted to large bodies of water, particularly areas located downstream of hydroelectric dams where there is access to dead or dying fish or waterfowl (Cooksey 1962; Ingram 1965). Food availability is probably the single most important factor affecting winter eagle distribution and abundance (Steenhof 1976). Waterfowl, particularly dead or crippled individuals, are often taken when fish are not readily available (Shickley 1961; Spencer 1976). In some regions, carrion is an important food source; deer, cattle, sheep, antelope, and road-killed cottontails and jackrabbits are readily utilized. Live mammals such as mice, cottontails, jackrabbits, gophers, woodrats, and kangaroo rats are also taken (Lish and Lewis 1975; Platt 1976; Beck 1980). Eagles may utilize alternate food sources, as availability changes.

Perches are an essential element in bald eagles' selection of foraging areas, since they are necessary for hunting and resting (Stalmaster and Newman 1979). Perch sites must be in open view of potential food sources and are generally within 160 feet of water (Vian 1971). Night roost sites offer protection from predators and a degree of protection from inclement weather. Large, live trees that occur in sheltered areas are preferred (Lish 1975). Eagles may roost individually or in small groups, and roosts can be used for successive years. Eagles generally leave the roost for feeding areas in the early morning and return in the evening, except during severe weather when they may remain at the roost throughout the day. Cottonwood (Populus spp.) would comprise preferred perches and roosting areas in the vicinity of the proposed project.

2.2.4 Endangerment Factors

The decline in eagle numbers, especially nesting pairs, was first reported by Howell (1937), with breeding populations disappearing entirely in some regions (Sprunt 1969). These declines were attributed to loss of habitat; human disturbance of nests, roosts, and perches; pesticide and lead contamination of prey, resulting in thinning egg shells and reduced reproductive success; illegal shooting, poisoning, and trapping; and electrocution (USFWS 1986).

Habitat loss for both breeding and wintering bald eagles is increasing within the United States. Increasing human activity and land development are adversely affecting the suitability of these wintering and breeding habitats, potentially resulting in increased harassment or killing of eagles.

Direct and indirect effects of organochlorine pesticides have severely impacted bald eagle populations (Bailey 1984). Dieldrin and DDE (DDT) are implicated most often in deaths of individual birds. Chronic exposure to DDE is known to inhibit reproduction by interfering with calcium metabolism, resulting in thinning eggshells and hatching failure (Bailey 1984). Although, bald eagle reproduction throughout the species' range appears to have improved since DDT and other organochlorine pesticides were banned for most uses since the early 1970s (Postupalsky 1978). Heavy metals such as mercury and lead have also caused eagle deaths. Secondary poison from eating lead-contaminated prey, particularly in wintering areas where eagles feed on crippled ducks and geese, appears to be a growing problem.

Another form of secondary poisoning occurs when eagles are exposed to lethal poisons associated with vertebrate pest control programs. Individual's intake of poisons, such as thallium, cyanide, strychnine, and 1080, happens predominantly when feeding on contaminated carcasses (USFWS 1986).

Electric distribution lines do pose an electrocution hazard to bald eagles; although electrocutions of raptors have decreased in recent years due to suggested standards for raptor protection (Olendorff et al. 1981). Transmission lines, however, do not present the same electrocution hazard as smaller distribution lines. Eagle collisions with power lines seem to occur with less frequency than electrocutions (USFWS 1986).

2.2.5 Presence in the Study Area

The Bighorn River located east of the study area provides both nesting and crucial wintering habitat for bald eagles (WGFD 1989). Nesting birds occur along the northern portion of the river; however, no active nest sites have been documented further west within the project area (Ritter 1989; Denton 1989).

Wintering birds arrive along the Bighorn River approximately October through March. Numbers of wintering eagles recorded from the area between the junction of the Wind River and Bighorn River north to Greybull have ranged between 18 birds in 1981 to 72 individuals in 1988. In 1989, the WGFD recorded 39 wintering eagles along this portion of the river. Numbers will fluctuate annually, partly due to the severity of the season and the time period of the surveys (Ritter 1989).

Individual eagles may move west into the study area to forage, particularly within mule deer winter range (Ritter 1989; Denton 1989). No historical or communal roost sights are known to occur along the riparian drainages located in the area (Ritter 1989); although, foraging areas, night roosts, and diurnal perches may be used during the migratory and wintering periods.

2.2.6 Impact Evaluation

Impacts to nesting bald eagles are not anticipated from project construction, operation, or maintenance, due to the distance of the study area from active bald eagle nest sites located along the Bighorn River. However, as stated in Mitigation Measures (Section 4.14) of the EA, clearance surveys will be initiated prior to project construction for the identification of active raptor nests within 0.5 mile of the proposed ROW. These surveys would then identify any potential eagle nests that may have been recently constructed.

Since wintering bald eagles primarily occupy the riparian areas along the Bighorn River, occasional birds may forage within the study area, especially along open water areas and near winter concentrations of other species. Project construction during this period (October through March) may inhibit eagles from occupying these areas near the disturbances; however, individuals would likely return to use this habitat upon the completion of construction. No communal roost sites are currently known to occur near the proposed transmission line routes, and the physical dimensions of the proposed 230-kV transmission line will reduce potential electrocution hazards to bald eagles. Therefore, no significant impacts to wintering bald eagles would be anticipated from project construction, operation, or maintenance activities.

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2.3 Peregrine Falcon

2.3.1 Status

The American peregrine falcon (Falco peregrinus anatum) is federally- listed as endangered and both breeds in and migrates through the continental United States. The Arctic peregrine falcon (F. p. tundrius) breeds from arctic Alaska through Greenland and migrates through the lower 48 states. The Arctic peregrine is listed as threatened on its breeding range, but either peregrine falcon occurring within the lower 48 states is considered endangered.

The peregrine falcon historically bred throughout North America; however, threats to the peregrine's existence increased dramatically during the human population expansion within the last century, resulting in severe declines in the breeding populations (USFWS 1984). The peregrine falcon became extinct as a breeding species east of the Rocky Mountains in the mid-1960s (Henny et al. 1982), and breeding populations within the western states were reduced by over 50 percent (Hickey 1969). By 1975, at least 75 percent of peregrine eyries in the western United States were inactive (Fyfe et al. 1976).

As an attempt to reestablish peregrine falcons within their historic range, the Peregrine Fund, Inc., has researched and created the feasibility of large-scale captive propagation of peregrines. Reintroductions (e.g., cross-fostering with prairie falcon, hacking, placing young in active peregrine nests) in the western United States began in 1974. A total of 128 captive-bred young were placed in eyries in Idaho, Wyoming, Utah, Colorado, South Dakota, and New Mexico between 1974 and 1982. In 1984, the Peregrine Fund's western facility alone hatched over 130 birds (USFWS 1984).

In addition to captive propagation, emphasis for species recovery is also placed on habitat improvement, which includes continuing evaluation of DDT contamination in peregrines and their prey and long-term public interest and support. The U.S. Fish and Wildlife Service is optimistic

that the peregrine population can recover and believes that an increase in population numbers is attainable (USFWS 1984).

2.3.2 General Distribution

Historically, the American peregrine falcon bred in an area ranging from Canada and Alaska south to Mexico. Reintroduction and management efforts have reestablished nesting peregrine falcons in many areas of the Rocky Mountains. Both the American and Arctic peregrine falcon may winter in or migrate through much of the lower 48 states.

The peregrine falcon has been reported as rare within Wyoming. Eighteen nest sites were known in the state prior to 1975; however, adequate documentation of all but seven of these sites was not completed until after 1975. No sites were known to be occupied by breeding birds from 1980 to 1983 (USFWS 1984).

Due to these reductions in peregrine numbers, reintroduction of birds was initiated in Wyoming during 1980. A total of 150 peregrines were successfully introduced to the wild between 1980 and 1988; the results have been encouraging. In 1984, a pair from previous reintroduction efforts nested at an historical eyrie that had not been occupied since 1969 and produced three young. Modeling results and observations of returning peregrines presently indicate that the reintroduction program is progressing as anticipated (WGFD 1989).

2.3.3 Life History and Habitat Requirements

Peregrine falcons mature at about 2 to 3 years of age. Adults usually return in mid-March to the same nest site each year, exhibiting a strong nest site attachment; however, an alternate nest site may also occur within the breeding territory (Fyfe et al. 1976). The female lays a clutch of three to four eggs in April, and both the male and female birds may incubate. The female typically performs the majority of the incubation, while the male provides prey species. The young hatch at about 33 days and are then cared for by both parents. Fledging occurs in June or July; soon afterwards the young are independent (USFWS 1984).

The four major habitat requirements for nesting are: 1) an inaccessible nest site; 2) adequate prey base; 3) proximity to water; and 4) isolation from human disturbance (Haynam et al. 1977). Peregrine falcons typically nest on cliffs near rivers, lakes, or marshes. Most nest sites are 150 feet or more in height with a small cave or overhanging ledge (USFWS 1984). The nest ledge will have loose soil, sand, gravel, and dead vegetation to allow the peregrine to construct a scrape for egg laying (Enderson and Craig 1974; Cade 1960).

The average hunting territory for a peregrine pair is usually within 10 miles of the nest, although individuals may travel up to 17 miles from nesting cliffs to forage. Preferred hunting areas include cropland, meadows, marshes, lakes, and rivers where prey species are abundant (Porter and White 1973).

2.3.4 Endangerment Factors

Several important factors have historically contributed to the decline of the peregrine: 1) eggshell thinning caused by pesticide poisoning; 2) trapping and taking of young by falconers; 3) shooting; 4) disturbance of nest sites by human encroachment; and 5) habitat destruction, resulting in reduction of prey availability (Herbert and Herbert 1965; Peakall 1974; Thelander 1976).

The marked decline in active peregrine eyries and the greatly reduced productivity of peregrines in the United States has primarily been in response to chemical poisoning and loss of habitat. Although DDE, a metabolite of DDT, has been proven to cause eggshell thinning, other chemicals and pesticides may also be a factor in successful reproduction efforts (USFWS 1984).

The peregrine falcon's position on the food chain greatly increases the impacts of pesticide accumulation, causing behavioral and physiological changes that result in reproductive failure. Eggshells collected between 1973 and 1979 in Colorado and New Mexico were 16 percent thinner than those collected prior to 1947 (Enderson et al. 1982). Concentrations of DDT as low as 15 parts per million can result in unsuccessful hatching (Peakall 1974).

The source of DDT appears to be predominantly migrant insectivorous birds that the peregrine preys upon (USFWS 1984). Migratory birds return to the United States from Latin America and may significantly contribute to peregrine contamination. These birds often accumulate significant amounts of pesticides which then can be passed on into the food chain. Organochlorine contamination was also found to be high in migratory peregrines; young birds wintering in Latin America their first year showed DDE accumulations nearly equal to those found in adult birds (Henny et al. 1982).

Disturbance of nest sites by human activities and habitat loss are also considered important factors that have contributed to peregrine falcon decline. The most sensitive period of disturbance is during courtship and incubation.

2.3.5 Presence in the Study Area

No active peregrine falcon eyries occur within the study area. Both the American and Arctic peregrine falcon would be considered rare migrants through the area (Ritter 1989; Denton 1989). Although potential peregrine habitat may exist along the rocky outcrops and cliffs (Denton 1989), the only crucial peregrine recovery habitat classified by the WGFD occurs within the Wind River Canyon located south of Thermopolis (WGFD 1989). No birds currently inhabit this canyon area.

The closest reintroduction efforts of peregrine falcons have been conducted along the South Fork of the Shoshone River north of the project area since 1988. Four young peregrines have been released each year at this site. No release sites occur near the study area (Oakleaf 1990).

2.3.6 Impact Evaluation

No adverse impacts to peregrine falcons are anticipated from the proposed project. Since no active peregrine eyries exist in the project region, breeding birds would not be affected. Similarly, the likelihood of the project affecting migratory individuals is low, since the species is considered a rare migrant through the area.

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3.0 SUMMARY

3.1 Black-footed Ferret

Prairie dogs are known to occur throughout the study area. The possibility for adverse impacts to black-footed ferrets exists because any active prairie dog colony is considered potential black-footed ferret habitat. To determine this potential, all prairie dog colonies and complexes will be mapped within 0.5 mile of the project ROW; active colonies will be identified; and clearance surveys in these active areas will be conducted for ferret presence prior to project construction. These clearance surveys, if required by the USFWS, must be conducted before a final evaluation of ferret impacts can be addressed.

3.2 Bald Eagle

Bald eagles do not nest in the study area, but they may occasionally forage in the area during the winter months, since wintering eagles primarily occur east of the study area along the Bighorn River. No communal roost sites are currently found within the project area, and electrocution hazards are not prevalent for a transmission line of this size. No significant impacts are anticipated to either resident or migratory bald eagles from the proposed project.

3.3 Peregrine Falcon

Peregrine falcons do not nest in or near the study area, but occur as occasional migrants. Impacts to peregrine falcons from the proposed project should not be significant, due to the infrequent occurrence of this species within the study area.

ATTACHMENT 1

AGENCY CORRESPONDENCE

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

Fish and Wildlife Enhancement
2617 East Lincolnway, Suite A
Cheyenne, Wyoming 82001

IN REPLY REFER TO:

W.35 Carter Mountain-Thermopolis 69-kV Transmission Line

November 6, 1989

Stephen A Fausett
Area Manager
Western Area Power Administration
P.O. Box 3700
Loveland, CO 80539

Dear Mr. Fausett:

This responds to your October 27, 1989 letter regarding the plans by the Western Area Power Administration's plans to rebuild 42 miles of the Carter Mountain-Thermopolis 69-kV transmission line in Hot Springs County, Wyoming.

In accordance with Section 7(c) of the Endangered Species Act of 1973, as amended (ESA), we have determined that the following listed and proposed threatened or endangered (T/E) species may be present in the project area.

Listed Species	Expected Occurrence
Black-footed ferret (*Mustela nigripes*)	Potential resident in prairie dog (*Cynomys* sp.) colonies.
Bald eagle (*Haliaeetus leucocephalus*)	Winter resident. Migrant.
Peregrine Falcon (*Falco peregrinus*)	Migrant.

Proposed Species

None

Your letter also requested information on candidate species. Category 2 candidate species that may occur within the project area are identified below.

Candidate Species	Expected Occurrence
Ferruginous hawk (*Buteo regalis*)	Summer resident

Section 7(c) of ESA requires that Federal agencies proposing major construction actions, complete a biological assessment to determine the effects of the proposed actions on listed and proposed species. If a biological assessment is not required (i.e., all other actions), your agency is responsible for review of proposed activities to determine whether listed species will be affected. We would appreciate the opportunity to review your determination document.

For those actions where a biological assessment is necessary, it should be completed within 180 days of initiation, but can be extended by mutual agreement between your agency and the Fish and Wildlife Service (Service). If the assessment is not initiated within 90 days, the list of T/E species should be verified with the Service prior to initiation of the assessment. The biological assessment may be undertaken as part of your agency's compliance of Section 102 of National Environmental Policy Act (NEPA), and incorporated into the NEPA documents. We recommend that biological assessments include:

1. a description of the project;
2. the current status, habitat use, and behavior of T/E species in the project area;
3. discussion of the methods used to determine the information in item 2;
4. direct and indirect impacts of the project to T/E species;
5. cumulative impacts from federal, state, or private projects in the area;
6. coordination measures that will reduce/eliminate adverse impacts to T/E species;
7. the expected status of T/E species in the future (short and long term) during and after project completion;
8. determination of "no effect/may affect" to listed species;
9. citation of literature and personal contacts used in assessment.

If it is determined that any agency program or project "may affect" any listed species, formal consultation should be initiated with us. If it is concluded that "no effect" is likely, we should be asked to review the assessment and concur with the determination of no effect.

A Federal agency may designate a non-Federal representative to conduct informal consultation or prepare biological assessments. However, the ultimate responsibility for Section 7 compliance remains with the Federal agency, and written notice should be provided to the Service upon such a designation. We recommend that Federal agencies provide their non-Federal representatives with proper guidance and oversight during preparation of biological assessments and evaluation of potential impacts to listed species.

Section 7(d) of ESA requires that the Federal agency and permit or license applicant shall not make any irreversible or irretrievable commitment of resources which would preclude the formulation of reasonable and prudent alternatives until consultation on listed species is completed.

Please contact us by mail at the above letterhead address or by telephone at 307-772-2374 (FTS 328-2374) if we can be of further assistance.

Sincerely,

R. G. Starkey

Ronald G. Starkey
State Supervisor
Wyoming State Office

cc:
Assistant Regional Director, FWE, Denver, CO (60120)
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RLH/RGS/skc (RLH\WAPACMTN.LTR)

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APPENDIX C

ELECTRICAL CHARACTERISTICS

ELECTRICAL CHARACTERISTICS

C.1 Line Characteristics

The electrical effects of the proposed 230-kV transmission line can be characterized as "corona effects" and "field effects." Corona is the electrical breakdown of air into charged particles caused by the electrical field at the surface of the conductors. Effects of corona are audible noise (AN), visible light, radio and television interference (RI and TVI), and photochemical oxidants. Calculated corona effects for the proposed project are shown in Table C-1. Field effects are induced currents and voltages in conducting objects near the line, and related effects that occur as a result of electric and magnetic fields at ground level. Calculated field values for the proposed project are shown in Table C-2.

C.1.1 Corona Effects

Corona can occur on the conductors, insulators, and hardware of an energized high-voltage transmission line.

1. AN. Transmission line AN is measured and predicted in decibels (A-weighted) or dBA. Some typical noise levels are: library, 40 dBA; light automobile traffic at 100 feet, 50 dBA; an operating air conditioning unit at 200 feet, 60 dBA; and freeway traffic or a freight train at 50 feet, 70 dBA. This last level represents the point at which a contribution to hearing impairment begins. The calculated average noise levels during wet weather and fair weather at the edge of the ROW for the proposed line are shown in Table C-1. These predicted levels would be below ambient levels.

2. RI, TVI, and Other Communication Band Interference. Corona-generated RI is most likely to affect the AM broadcast band. FM radio reception is rarely affected. In general, only AM radio receivers near transmission lines are affected by RI. An acceptable level of maximum fair weather RI at the edge of a ROW is 40 to 45 decibels above 1 microvolt per meter (dBμV/m). The predicted fair-weather and foul-weather levels for the proposed transmission line are shown in Table C-1.

   The level of corona-generated TVI expected from the line is also shown in Table C-1. These levels are not expected to produce a TVI problem.

   Corona can affect the reception of the video (picture) portion of a TV signal. TVI due to corona appears as three bands of "snow" on the television screen. TVI at the edge of the right-of-way due to corona occurs during foul weather and is generally of

TABLE C-1

Calculated Corona Effects for the Carter Mountain to Thermopolis Transmission Line Project[1]

	Voltage, kilovolts (kV)	ROW Width, feet	Average Conductor Height Above Ground, feet	Average Wet-weather Audible Noise at Edge of ROW, decibels A-weighted (dBA)	Average Fair-weather Audible Noise at Edge of ROW, decibels A-weighted (dBA)	Average Foul-weather Radio Interference (RI) at Edge of ROW, decibels above 1 microvolt per meter (dBμV/m)	Average Fair-weather Radio Interference (RI) at Edge of ROW, decibels above 1 microvolt per meter (dBμV/m)	Television Interference (TVI) at Edge of ROW, decibels above 1 microvolt per meter (dBuV/m)	Maximum Incremental Ozone-levels at Ground Level, parts per billion (ppb)[3]
Existing 69-kV system with No. 1/0 AWG copper conductor on H-frame wood pole	69	75	31	15.7	-9.3	38.0	21.0	0.3	0.012
115-kV operation of proposed system built for 230-kV ultimate operation (1,272,000 circular mil conductor)									
H-frame wood pole[2]	115	105	35	9.7	-15.3	23.5	6.5	-15.5	0.002
Single-pole steel[2]	115	95	40	8.4	-16.6	24.0	7.0	-15.4	0.001
Lattice steel tower[2]	115	150	44	6.4	-18.6	18.0	1.0	-20.4	0.001
230-kV operation (1,272,000 circular mil conductor)									
H-frame wood pole[2]	230	105	35	45.8	20.8	59.6	42.6	20.6	0.16
Single-pole steel[2]	230	95	40	44.5	19.5	60.1	43.1	20.7	0.11
Lattice steel tower[2]	230	150	44	42.5	17.5	54.1	37.1	15.8	0.10

[1] Since corona effects are produced as a result of system voltage, the corona effects will be the same for all system currents (loads).

[2] Single-circuit (1 ckt.) configuration.

[3] Calculation assumes a 1.0 mph perpendicular wind and a 0.05 inch/hr rain.

TABLE C-2

Calculated Field Effects for the Carter Mountain to Thermopolis Transmission Line Project

	Existing 69-kV System with No. 1/0 AWG Copper Conductor		115-kV Operation of Proposed System Built for 230-kV Ultimate Operation (1,272,000 Circular Mil Conductor)						230-kV Operation (1,272,000 Circular Mil Conductor)					
	1	2	1,4			2,4			1,4			2,4		
	H-frame Wood Pole[3]	H-frame Wood Pole[3]	H-frame Wood Pole[3]	Single -pole Steel[3]	Lattice Steel Tower[3]	H-frame Wood Pole[3]	Single -pole Steel[3]	Lattice Steel Tower[3]	H-frame Wood Pole[3]	Single -pole Steel[3]	Lattice Steel Tower[3]	H-frame Wood Pole[3]	Single -pole Steel[3]	Lattice Steel Tower[3]
Voltage, kilovolts (kV)	69	69	115	115	115	115	115	115	230	230	230	230	230	230
Current, amperes (A)*	56	286	80	80	80	152	152	152	382	382	382	585	585	585
ROW width, feet	75	75	105	95	150	105	95	150	105	95	150	105	95	150
Minimum conductor height above ground, feet	22	20.3	27.3	27.8	28.0	27.3	27.8	28.0	27.2	27.4	27.5	28.4	28.8	28.9
Maximum electric field, kilovolts per meter (kV/m)	0.85	0.89	1.72	1.76	1.78	1.72	1.76	1.78	3.51	3.61	3.63	3.64	3.73	3.75
Electric field at edge of ROW, kilovolts per meter (kV/m)	0.35	0.38	0.77	0.73	0.39	0.77	0.73	0.39	1.54	1.46	0.77	1.56	1.46	0.77
Maximum magnetic field, Gauss (MG)	15	8	19	17	19	38	33	38	82	85	93	141	130	142
Magnetic field at edge of ROW, Gauss (MG)	4	22	7	6	4	13	12	8	32	30	20	48	45	30

1 Predicted maximum current with power system intact.

2 Predicted maximum current based on an outage of one line or other element in power system.

3 Single-circuit (1 ckt.).

4 The transmission line design criteria would be based on maintaining a minimum conductor to ground height of 25 feet with a conductor temperature of 80°C. This condition would be expected to occur with a 1272 MCM conductor maximum current of 1150 amperes based on a conductor temperature rise of 40°C above a 40°C ambient air temperature. It is not anticipated that actual system operating currents would ever reach this conductor maximum.

All the given system operating currents are projected values calculated from the system planning studies.

concern only for transmission lines with voltage of 345-kV or above. The proposed line will be designed to minimize TVI.Corona-generated interference usually does not cause disruption on other communication bands such as the citizens' (CB) and mobile bands due to the higher frequencies of these signals. Complaints of interference to CB radios are rare. Mobile radio communications are not susceptible to transmission line interference because they are generally frequency modulated (FM). These FM signals would not normally be affected.

There are various mitigative techniques for eliminating adverse impacts to radio, television, and other communication band reception. In the unlikely event that interference occurs with these types of communications, various mitigation measures are available to correct specific problems. Individual complaints about interference, should they occur, will be resolved by Western.

3. Visible Light. Corona is visible as a bluish glow or as bluish plumes. On the proposed line, corona levels will be so low that corona on the conductors will not be observable.

4. Photochemical Oxidants. When corona is present, the air surrounding the conductors is ionized and chemical reactions can take place, producing extremely small amounts of ozone and other oxidants. Approximately 90 percent of the oxidant is ozone and the remainder is mainly nitrogen oxides.

The National Primary Ambient Air Quality Standard for photochemical oxidants, of which ozone is the principal component, is 235 micrograms/cubic meter ($\mu g/m^3$) or 120 parts per billion (ppb). The approximate maximum incremental ozone levels at ground level calculated for the proposed line are given in Table C-1 and are well below the 120 ppb standard. Measurements near transmission lines have shown that the amount of oxidants produced by operating transmission lines is barely measurable and of no environmental consequence.

C.1.2 Field Effects

As indicated earlier, field effects are induced currents and voltages in conducting objects near the line, and related effects that occur as a result of electric and magnetic fields near ground level. Table C-2 has been prepared to assist the reader in understanding the changes in intensity of the field parameters for the various construction alternatives. The table shows the calculated value for the various field parameters for the three voltage classes (69, 115, 230-kV), structure type and configuration, and the predicted system load currents.

1. Electric Field

The electrical field created by a high-voltage transmission line extends from the energized conductors to other conducting objects, such as the ground, structures, vegetation, buildings, vehicles, people, and animals. The electric field or voltage gradient is expressed in units of volts/meter (V/m) or kilovolts/meter (kV/m).

a. Induced Currents. When a conducting object, such as a vehicle or person, is placed in an electric field, currents and voltages are induced in the object. The magnitude of the induced current depends on the electric-field strength and the size and shape of the object. If the object is grounded, then the induced current flows to earth and is called the short-circuit current of the object. In this case, the voltage on the object is effectively zero. If the object is insulated (not grounded), then it assumes some voltage relative to ground. These induced currents and voltages could represent a potential source of nuisance shocks near a high- voltage transmission line.

Some representative short-circuit currents in electric fields of 1.0 kV/m and 3.0 kV/m are given in Table C-3.

The possibility of the total short-circuit current being available for a shock is further diminished by less-than-ideal conditions, such as conducting tires, vegetation touching the vehicle, or moisture. However, the values in Table C-3 do allow an upper limit to be placed on short-circuit currents. If a person provides the only conducting path from the object to ground, then the currents listed in Table C-3 would flow through the person and cause a nuisance shock.

b. Steady-State Induced Current. Steady-state currents are those that flow continuously after a person contacts an object and provides a path to ground for the induced current. The response of persons to such currents has been extensively studied and levels of human response documented (Keesey 1969). Primary shocks are those that can result in direct physiological harm. The lowest category of primary shocks is "let go," which represents the steady-state current that cannot be released voluntarily. The "let go" threshold was established for adult males at 9.0 mA and 6.0 mA for adult females. These thresholds were established for adult men weighing 180 pounds and adult women weighing 120 pounds. Let-go thresholds for adults have been established from actual experimentation. Thresholds for children, however, have been derived from the data for adults, since no actual measurements were

TABLE C-3

Short-Circuit Currents for Various Objects in Milliamperes (mA) - 120° NESC Conditions

Object	Electric Field	
	1 kV/m	3.0 kV/m
Person	0.016	0.05
Cow	0.024	0.07
Sedan	0.11	0.33
Camper Truck (28' long)	0.28	0.84
Largest anticipated vehicle without special permit (70 x 8.5 x 13)[1]	0.93	2.79*
Large haystacker and a 4 WD tractor[2]	0.89	2.67*
3-strand fence (200' long)	0.30	0.90

[1] Largest anticipated vehicle (CRS 42-4-401 et. seq.).

[2] Estimated from vehicle with increment of 0.07 mA/kV/m for 4-wheel drive versus 2-wheel drive tractor.

* - Note: Practically, the average field over the larger objects will result in a lower induced current than reported here. The NESC maximum induced current criterion for vehicles is 5 mA. Large pieces of farm equipment, such as hay wagons and combines, would have large short-circuit currents but would not exceed this level.

taken from children. The derivation of a threshold for children was based on body weight, and is generally accepted as 5.0 mA (the value adopted by the National Electric Safety Code [NESC]). Primary shocks will not be possible fromthe induced currents under the proposed line because of the line's relatively low field strengths and the grounding practices that will be used. Potential, steady-state current shocks from vehicles under the proposed line would be at or below the secondary shock level, where secondary shocks are defined as those that could cause an involuntary and potentially harmful movement, but cause no direct physiological harm.

Several factors tend to reduce the opportunity for secondary shocks to occur. If activities are distributed over the whole right-of-way, then only a small percentage of time will be spent in areas where the field is at or close to the maximum value. If road crossings are kept near the towers, where conductors are highest, the vehicular traffic in high field-strength areas, where conductors are lowest, will be restricted to farm machinery on soil or vegetation, which tends to reduce shock currents substantially.

Because of these mitigating factors, it is very likely that most steady-state current shocks will be below the 1.1 mA perception level for 50 percent of men and, in fact, less than the 0.5 mA standard for maximum leakage current from portable appliances. Thus, steady-state current shocks are not anticipated often, and, if they occur, would represent a nuisance rather than a hazard.

c. <u>Spark-Discharge Shocks</u>. Induced voltages appear on objects, such as vehicles, when there is an inadequate ground. If the voltage is sufficiently high, then a spark-discharge shock can occur as contact is made with the object. Such shocks are similar to "carpet" shocks, which occur when touching a door knob after walking across a carpet on a dry day. Spark-discharge shocks could occur under the proposed line. However, the magnitude of the electric field would be low enough that this type of shock would be rare and would occur only in a small area under the line near midspan.

Carrying or handling conducting objects under the line can also result in spark discharges that are a nuisance. Irrigation pipe should be carried as low to the ground as possible and preferably unloaded at a distance from the transmission line to eliminate spark-discharge nuisance shocks. The primary hazard with irrigation pipe is direct contact with the conductors.

d. Field Perception. When the electric field under a transmission line is sufficiently great, it can be perceived by hair erection on an upraised hand similar to the sensation of a slight breeze blowing over the hand or arm. It is very unlikely that the electric field under the line would be perceivable when standing on the ground. When working on top of equipment, there is probably enough skin stimulation during normal activities to preclude perception of the field at all.

e. Grounding and Shielding. Normal grounding policies effectively mitigate the possibility of nuisance shocks due to induced currents from stationary objects such as fences and buildings. Since the electric field extends beyond the right-of-way, grounding requirements extend beyond the right-of-way for very large objects or extremely long fences. Electric fences require a special grounding technique because they can only operate if they are insulated. Application of the grounding policy during and after construction will effectively mitigate the potential for shocks from stationary objects near the proposed line.

Mobile objects, such as vehicles and farm machinery, cannot be grounded permanently like a fence or building. Limiting the coupled currents to persons from such objects is accomplished in three ways. First, the NESC requires that lines be designed such that the conductor clearance for lines with voltage exceeding 169-kV results in an induced short-circuit current in the largest anticipated vehicle under the line of less than 5 mA.

A second method of reducing potential currents to persons is through the intentional use of grounds. For example, a chain or other conductor can be dragged by a vehicle; a ground strap can be attached to the vehicle when it is stopped.

Third, the very nature of large vehicles and their use tend to provide some grounding and reduce the electrical resistance of the vehicle to ground. Tires tend to be conductive, farm machinery is usually in direct contact with the soil, and conducting vegetation is in contact with equipment. Because of these factors, the realization of a well-insulated (worst-case) vehicle is a remote possibility.

Electric-field reduction and the accompanying reduction in induced effects, such as shocks, is also accomplished by conductive shielding. Persons inside a conducting-vehicle cab or canopy will be shielded from the electric field. Similarly, a row of trees or a low-voltage distribution line will reduce the field on the ground in their vicinity. Metal pipes, wiring, and other conductors in a

residence or building will shield the interior from the electric field due to the transmission line.

Impacts of electric-field coupling can be mitigated through grounding policies and adherence to the NESC. Worst-case levels are used for safety analysis, but, in practice, currents and voltages are reduced considerably by both intentional and inadvertent grounding. Shielding by conducting objects, such as vehicles and vegetation, also reduces the potential for electric-field effects.

2. Magnetic Fields

Magnetic fields are produced by the flow of electrons or current. Magnetic fields are present near any energized current-carrying object, or conductor, including all common electrical household appliances and home wiring during use. Since the standard North American power frequency is 60-hertz (Hz), magnetic fields also alternate at the standard 60-Hz a-c frequency. Magnetic fields have been traditionally measured in Gauss (G), which is a measure of the intensity of the magnetic attraction (lines of force) per unit area, or magnetic flux density. Since the Gauss is a relatively large quantity, the milligauss (mG) unit is often used when dealing with the low field strengths associated with most human exposures (1 Gauss = 1,000 mG or 0.001G = 1 mG). Magnetic field strengths are directly related to, among other factors, the amount of current flowing in the conductor; the greater the current flow, the higher the magnetic field. Therefore, unlike electric fields, magnetic fields can vary significantly over time, fluctuating with system loads.

Magnetic fields associated with transmission lines behave similarly to electric fields in that they are most intense very near the conductors and fall away relatively quickly as the distance from the conductor increases. The partial cancellation effect of adjacent conductors also occurs with magnetic fields, as it does with electric fields. However, where electric fields are rather easily shielded, magnetic fields penetrate structures and soil with little decrease of field strength. Physical distance, thus, becomes a very important factor in limiting magnetic fields.

The actual level of magnetic field will vary with current loading, conductor temperature, and ground clearance. The maximum calculated 60-Hz magnetic field on the right-of-way is shown in Table C-2 for various system loading conditions and structure types.

The maximum magnetic field levels shown in Table C-2 are comparable with maximum magnetic fields of other transmission lines and with levels of magnetic fields measured

TABLE C-4

Magnetic Field Environment

Summary of Domestic Appliance Magnetic Field Measurements

Appliance Type	Body Location	Magnetic Field - mG Typical Range	Maximum Value
Range	Belt	1-80	175-625
Refrigerator	Chest	1-8	12-187
Microwave Oven	Belt	3-40	65-812
Can Opener	Belt	30-225	288-2750
Oven	Belt	1-8	14-67
Toaster	Belt	2-6	9
Coffee Maker	Chest	1-2	4-25
Freezer	Head	1-3	4-6
Mixer	Belt	2-11	16-387
Clothes Dryer	Belt	1-24	45-93
Dishwasher	Belt	1-15	28-712
Garbage Disposal	Belt	1-5	8-33
Ceiling Fan	Head	1-11	125
Electric Blanket	Belt	3-50	65
Waterbed Heater	Belt	1-9	20-27
Blow Dryer	Head	1-75	112-2125
Computer	Belt	1-25	49-1875
Typewriter	Belt	1-23	38
Make-up Mirror	Chest	1-29	44-125
Shaver	Head	50-300	500-6875
Aquarium	Belt	1-40	50-2000
Sewing Machine	Chest	1-23	26-1125
Electric Drill	Chest	56-194	300-1500
Circular Saw	Belt	19-48	84-562

close to some common household appliances as shown in Table C-4 (Silva et al. 1989; Lee et al. 1985; Gauger et al. 1985).

a. Magnetically Induced Currents and Voltages. Alternating magnetic fields induce voltages at the open ends of conducting loops. The conducting loop can be formed by such things as a fence, an irrigation pipe, a pipeline, an electrical distribution line, or a telephone line. The earth to which one end of the conductor is grounded forms the other portion of the loop. The possibility for a shock exists if a person closes the loop at the open end by contacting both the ground and the conductor. Shocks due to magnetically induced currents and voltages are the same type as those due to electric field-induced currents and voltages. In the case of magnetic induction, the voltages are generally quite low and the currents are limited by the resistance in the current path.

Normally, the resistance of shoes will limit the current to levels below the threshold for perception. However, a low resistance contact (standing barefoot on damp earth) with a long insulated fence parallel to a heavily loaded transmission line can result in steady-state currents above threshold and even above let-go. This latter possibility is very unlikely because of the length of ungrounded fence required. Mitigation measures, such as grounding and breaking electrical continuity, that are implemented for electric-field induction will also mitigate magnetic-field induction effects.

Magnetically induced currents from power lines have been investigated for many years (IEEE 1974; Jaffa and Stewart 1981; Jaffa 1981; Taflove and Dabkowski 1979; Olsen and Jaffa 1984). Calculation methods and mitigating measures are available. A recent comprehensive study of gas pipelines near transmission lines developed prediction methods and mitigation techniques specifically for induced voltages on pipelines (Taflove and Dabkowski 1979; Dabkowski and Taflove 1979). Similar techniques and procedures are available for irrigation pipes and fences.

Induction effects in adjacent facilities such as pipelines and communication systems have been well studied and mitigation is handled with the affected parties on a case-by-case basis (Elek and Rokas 1977; Taflove et al. 1979).

The magnitude of magnetic field-induced currents for both pipes and fences is very dependent on the electrical unbalance (unequal currents) of the three phases of the line. Thus, a distribution line where a phase outage can go

unnoticed for long lengths of time can represent a larger source than a transmission line where the loads are well balanced (Jaffa 1981).

Results from an investigation of electric shock due to magnetically coupled currents to fences during electrical fault conditions concluded that a hazardous situation would be extremely unlikely to occur (Mohan et al. 1982). Although a 400-kV dc line in Minnesota was considered, the results apply to an ac line as well, because they were considering fault conditions.

Furthermore, standard grounding practices for fences are effective in reducing the energy available for shock well below that considered to be dangerous.

Knowledge of the phenomenon, grounding practices, and the availability of mitigation measures mean that magnetic induction effects from the line can be minimized. Therefore, it is unlikely that magnetically induced voltages and currents would have an adverse impact.

C.2 Biological Effects

C.2.1 Human Studies

The question of whether long-term, direct exposure to the EMFs from transmission lines causes biological or health effects in humans is a controversial topic. Much attention at present is focused on several recent reports suggesting that workers in certain electrical occupations and people living close to power lines have a small increased risk of leukemia and other cancers (Coleman and Beral 1988). An EPA draft report (EPA 1990) identifies 60-Hz fields and magnetic fields from power lines and perhaps other sources in the home as possible, but not proven causes of cancer in humans.

Over the past decade, research addressing the existence and implications of possible effects has been conducted with humans, animals, and cells and tissues. The results of this research and the question of possible health effects due to 60-Hz electric and magnetic fields have been analyzed and reviewed by numerous authors and scientific panels. Reviews of the literature and research related to possible health effects of 60-Hz electric and magnetic fields have been prepared by: World Health Organization (WHO 1984); American Institute of Biological Sciences (AIBS 1985); Florida Electric and Magnetic Fields Science Advisory Commission (FEMFSAC 1985); Bonneville Power Administration (BPA) 1979; (Lee et al. 1985); Western Energy Supply and Transmission Associates (WEST 1986); New York State Power Line Project (NYSPLP) (Ahlbom et al. 1987); Ontario Ministry of Health (Ontario 1987); and EPA 1990.

These reviews were prepared by groups of scientists familiar with the scientific literature. Each group evaluated, wholly or in part, the results of epidemiology studies, human laboratory studies, animal studies, and cell and tissue studies. The reviews addressed the electric and magnetic field bioeffects literature with varying degrees of thoroughness and with different emphases.

Both residential and occupational studies have examined associations between exposure to power frequency fields and cancer. The results of the residential studies have been very inconsistent: some report a possible increased risk of cancer, others find no evidence of an increased risk, and still another study shows that the risk of cancer decreased for individuals living in certain homes (where magnetic fields were greater than 4 milligause) near power lines. The U.S. and several other countries are continuing research to obtain more definitive information on a possible association between power lines and other electrical devices and cancer.

1. Residential Studies

The possible association of childhood leukemia with magnetic fields was first raised by Wertheimer and Leeper (1979). They observed a positive association between the electrical distribution system wiring in Denver, Colorado, and the incidence of childhood leukemia. They found that cancer cases were more likely to live near high-current configurations (HCC), than near low-current configurations (LCC). HCCs are primary and secondary wiring configurations that, because of their location or wire size, are assumed to carry more electric current and, hence, to be stronger sources of magnetic fields than LCCs. These configurations are proxy measurements of magnetic fields and the study was not based upon measurements of actual magnetic field exposure. The researchers concluded from their observations that an association may exist between magnetic fields from residential distribution lines and childhood cancer. The cancer risk appeared to be two or three times greater for residences near HCCs. Wertheimer and Leeper (1982), in a second study in the Denver area, found association of the incidence of adult cancer with HCCs. Both studies have been criticized because of problems in the methodology and the analysis (e.g. Miller 1980; Roth 1985).

Fulton et al. (1980) performed a similar study in Rhode Island but did not observe an association between childhood cancer and wiring configuration. A more recent study in the Seattle area employing improved exposure characteristics found no association between measured magnetic fields or wiring codes and the incidence of adult leukemia (Stevens 1986). In the Seattle study, exposure in each of 43 houses was characterized by: 24-hour measurement of field, spot field measurements on a different day; and, the wiring coding classification according to the Wertheimer-Leeper code (Kaune et al. 1987). There was a weak correlation between the 24-hour measurements and wiring code. However, the best

prediction of 24-hour residential magnetic fields was a formula developed through post-hoc regression analysis of the data. The three characteristics within 140 feet of a home that could be used to predict magnetic field were the presence of transmission lines, number of primary phase conductors, and number of service drops. This latter factor seemed to be the most important. Again, this improved study showed no association with adult cancer.

Tomenius et al. (1982) (Tomenius 1986) measured magnetic field levels at the front doors of residences of childhood tumor cases and matched controls in Stockholm, Sweden. The incidence of cancer was greater than expected in residences near 200-kV lines and with measured fields of 3 mG or greater. An approximate two-fold increase in tumor rate was reported for dwellings with visible 200-kV lines. However, the increased incidence of tumors was not apparent for residences with fields that exceeded 4 mG (Tenforde 1986), and the data show that the relative risk of cancer consistently decreases the nearer these homes are to power lines.

A childhood cancer study was performed in the Denver area by Savitz et al. (1987a; 1987b). This work was part of the NYSPLP and used both the Wertheimer-Leeper wiring codes and magnetic field measurements in the home as exposure indicators. Magnetic field measurements in residences were made in both a low power condition with the major appliance and lights off and with the same sources turned on. The childhood cases and controls in this study were different than those in the previous Denver study (Wertheimer and Leeper 1979). Savitz observed a slight association between cancer cases and proximity to HCCs: a risk ratio of 1.53 was observed relative to non-HCC homes; i.e., the increased risk associated with HCCs was about 50 percent. Because of the limited number of cases and other uncertainties, this did not vary significantly (statistically) from no increased risk. (A risk ratio of 1.0 represents no increased risk.) These results have been reinterpreted by Savitz in his recent publication.

In both epidemiologic studies done for the NYSPLP (Stevens 1986; Savitz 1987) a correlation between measured magnetic field and wire coding was found, giving some credence to the use of wire coding as a surrogate for historical exposure to magnetic fields. However, the association between magnetic fields and the incidence of cancer is very tenuous. One of the investigators in the recent Denver study has speculated that some factor other than magnetic fields, associated with wiring code, may be linked more strongly with cancer (Wachtel et al. 1987).

Finally, preliminary results of a study examining childhood leukemia risk from EMF exposure were released on February 7, 1991 by the Electric Power Research Institute (EPRI). The study, conducted by John M. Peters, M.D. of the University of Southern California, examined 232 cases of childhood leukemia which occured in children ages 10 and younger between

1980 and 1987 in Los Angeles. Researchers interviewed parents of leukemia victims by telephone, measured electric and magnetic fields in their homes, conducted like examinations of a control group of 232 children who did not have leukemia, and evaluated power lines outside the childrens homes using wiring codes similar to previous studies (Peters 1991).

The preliminary findings are complex and somewhat contradictory and include:

- no association between measured electric fields and leukemia;
- a weak, statistically insignificant, correlation between magnetic field measurements in the children's bedroom and leukemia;
- a statistically significant correlation between wiring codes and leukemia; and
- a statistically significant association between the use of appliances (hair dryers and black and white televisions) and leukemia.

The Peters findings, though generally consistant with earlier studies such as the Savitz work, continued to present further research needs. Particularly of interest are the reasons why wiring configuration is again observed to correlate better with leukemia risk than measured exposure. The question os an apparent appliance use correlation with leukemia also bears further examination.

2. Occupational Studies

During the past several years, several epidemiologic reports have shown an association between the incidence of adult leukemia or cancer and occupations that involve exposure to electric and magnetic fields, the so-called "electrical worker" categories. Milham (1982) reported an elevated number of leukemia deaths (36 percent) for workers in 10 electrical occupations in the state of Washington. Numerous surveys of other occupational populations have subsequently appeared with varying results. Savitz and Calle (1987) compiled data from 11 studies in which incidence of leukemia was investigated as a function of possible occupational exposure. These data sets included the original Milham data. Their intent was to assess the consistency of the data that suggested an increased risk of leukemia among electrical workers. The summary relative risk across all studies and all jobs was a modest 1.2 for leukemia and a higher 20 to 50 percent increase in risk for acute leukemia. However, they noted that the available data were not adequate to conclude that electric and magnetic field exposures are the source of the increased risk.

In assessing the significance of their results, Savitz and Calle (1987) noted the lack of specificity of risk for leukemia: that is, other cancers also showed increased risks when analyzed by job title, which would imply that magnetic fields were associated with multiple types of cancer. Identification of exposure through related occupation was also a weakness in the studies because of variation of exposure within a specific occupation, and the possible absence of exposure measurements for some of these occupations.

Six studies of human reproductive effects attributable to electric and magnetic field exposures have been reviewed by the Ontario Ministry of Health (1987). These studies included reproductive experience of the female spouses of high-voltage workers (Nordstrom et al. 1983) and possible effects associated with the use of electric blankets and heated waterbeds. The conclusion reached by the Ontario Ministry of Health was that "none of the studies to date presents convincing evidence to support an association between adverse reproduction outcomes and electromagnetic field exposure."

Other reviews of the epidemiologic literature have not identified health hazards associated with electric and magnetic field exposure nor have they found support for a causal relationship between cancer and magnetic fields (WEST 1986; Ahlbom et al. 1987; Ontario 1987). These findings are consistent with numerous earlier reviews, which have been summarized in Lee et al. (1985) and WEST (1986). However, a draft EPA report (EPA 1990) concluded that several studies show a consistent pattern of response that suggests, but does not prove, a causal link between the occurrence of cancer and exposure to electric and magnetic fields.

C.2.2 Agricultural Studies

1. <u>Honeybees</u>. Effects of transmission line fields on honeybees have been studied extensively (Wallenstein 1973; Rogers et al. 1982; Greenberg et al. 1981; Greenberg and Bindokas 1980; Greenberg et al. 1984). When hives are placed in electric fields of 2 to 4 kV/m, behavioral effects can occur in honeybees. Fields of 7 to 12 kV/m can result in a variety of problems, including mortality. Intensive studies of the nature of the problem and its causation have demonstrated that bees are not harmed by electric fields per se of 10.50, or even 100 kV/m even when exposed for 800 hours. Hence, foraging and other activities are not likely to be affected. However, when honeybee hives are placed in strong electric fields, currents and voltages are induced in the hive which are dependent on field strength, hive characteristics, and moisture conditions. If the field is high enough, there is a significant voltage difference across the dimensions of a bee's body. This "step potential" results in a shock to the bee when it takes a step. These shocks, and not the electric field per se, are a source of irritation for bees and can cause physiological damage, including death (Greenberg et al. 1984). Not surprisingly, honey production falls off and other activities become

erratic. Fortunately, there are two simple solutions to the problem. One is to avoid keeping bees in high field regions on transmission line rights-of-way, and the other is to place grounded metal cages or screens over the hives.

The fact that no behavioral effects have been seen in shielded hives under operating transmission lines indicates that 60-Hz magnetic fields are not sufficient to cause the shock conditions that exist from electric field induction.

Beekeepers with hives located on the final right-of-way of the proposed line will be advised of the possible adverse effects to bees and compensated fairly to assist in relocation of hives. The maximum fields beyond the right-of-way for the proposed line will not exceed the threshold levels where effect on the bees has been observed. Therefore, there will be no impact beyond the right-of-way.

2. Crops. High electric fields (15 kV/m) have been observed to induce corona on the uppermost parts of plants (McKee et al. 1978; Rogers et al. 1982). The induced corona causes minor damage to leaf tips. Studies of the effects of electric fields on crops and other plants have been conducted under controlled greenhouse conditions and under transmission lines.

The most extensive analysis on effects of 60-Hz electric fields on living plants has been done by McKee and co-workers at the Pennsylvania State University (McKee et al. 1978). In initial studies, several thousand plants from 85 different species were exposed to fields from 0 to 50 kV/m in a very controlled greenhouse environment. "Damage" to plants was associated with sharp, or pointed, leaf tips and amounted to self-limiting corona damage to a few millimeters of these pointed plant parts. Tip damage began for some species at fields of 15 to 20 kV/m. According to McKee, the damage was less than that seen due to routine drying under normal field conditions and, even at 50 kV/m, never threatened the overall growth, viability, yield, or reproduction of exposed plants.

In follow-up studies, McKee (1985) exposed five types of plants - alfalfa, tall fescue, sweet corn, and two types of wheat - to 60-Hz electric fields for extended periods.

Plants were extensively analyzed for chemical element content and for an extremely wide species-specific array of size and mass parameters. There were "no statistically significant effects on seed germination, seedling growth, plant growth, phenology, flowering, seed set, biomass production, plant height, leaf area, plant survival, and nodulation." The only consistent effect that resulted from exposure was the expected

occasional damage to a few millimeters of the terminal tip of plant parts exposed to fields of 30 kV/m or greater.

Studies of peas and barley conducted over several years under a BPA 1200-kV test line indicated no consistent adverse effects attributable to exposure to about 12 kV/m (Rogers et al. 1982). In this same study, conifers growing close to a 1200-kV test line exhibited corona at the tips of needles and corona damage to the growing tips of some trees closest to the line. Right-of-way management practices normally limit tree growth in the immediate vicinity of the conductors, and there is no suggestion that forest growth or timber production adjacent to power lines would be affected by electromagnetic fields.

Electric fields up to 12 kV/m under operating lines and up to 16 kV/m under a test line had no noticeable effects on growth or productivity of corn and other crops commonly grown in Indiana (Hodges and Mitchell 1979; 1984). However, some crops growing in the maximum field area exhibited minor damage from induced leaf tip corona.

In summary, the effects of 60-Hz electric fields on plants is limited to corona damage at sharp, terminal plant parts. This effect is too limited to be noticeable under field conditions found under operating transmission lines and does not result in crop damage. The electric fields associated with the proposed line are well below levels where the leaf tip corona phenomenon has been observed. No damage or harm to crops will occur due to the fields under the proposed line.

3. Livestock. Numerous studies have investigated the performance of livestock in the electrical environment of high-voltage ac transmission lines. Over a 2-year period, Amstutz and Miller (1980) studied livestock, including beef and dairy cattle, on 11 farms located near a 765-kV ac transmission line in Indiana. Typical maximum electric fields were 8.5 kV/m with levels up to 12 kV/m. Magnetic flux densities of .056 G (56 mG) were measured with higher values expected during periods of higher current flow. Short-circuit currents for cows were 0.1 to 0.2 mA in a 6 to 8 kV/m field. Cows seemed to react to induced currents of about 0.7 - 0.8 mA from an insulated feed trough. The authors concluded that "neither health, behavior, nor performance were affected by the electric and magnetic fields created by the 765-kV line."

Williams and Beiler (1979) investigated 55 dairy farms located within 0.5 mile of 765-kV lines in Ohio. Herd performance was evaluated from milk production records, farm records, and interviews for a 6-year period - 3 years before line energization and 3 years after. Milk production did not appear to be affected by the presence of the 765-kV lines. After the lines had been constructed, the incidence of calf mortality and birth defects per farm increased. However, the investigators felt these changes may have been due to larger herd sizes after the line was constructed, to changes in farm management, and to bias in reporting. Farmers involved in the study did not believe there was any significant change in the performance of their herd following line energization. The study indicated that there were no obvious effects of the 765-kV transmission line. The data suggested that the largest factors in herd performance were farm management, quality of feed, and, on occasion, change in ownership.

A Swedish study of 106 farms, located under 400-kV ac transmission lines, found that herds exposed to 400-kV ac transmission lines for more than 15 days per year did not have decreased fertility relative to other herds (Hennichs 1982). There was also no relationship between exposure and the number of cows slaughtered on each farm because of reduced fertility.

All herds used artificial insemination. Exposure days for each herd were estimated from the percent of pasture occupied by the transmission line and the number of days animals were in the pasture. No field measurements were made in this study, but the maximum electric field strength measured under 400-kV lines on 11 farms in Sweden was 5kV/m (Algers, Ekesbo, and Hennichs 1981). Magnetic fields were not reported but would presumably be at least comparable with those of 230-kV lines in the USA: In one case, a maximum of 0.12 G, 120 mG, has been reported (Lee et al. 1985).

In a behavioral study conducted underneath the BPA 1200-kV prototype ac line in Oregon for 5 years, cattle showed no reluctance to graze or drink beneath the line (Rogers et al. 1982). The maximum electric field was 12 kV/m. There was no magnetic field associated with the prototype line. However, an adjacent 230-kV line would have resulted in magnetic fields above typical rural levels.

Exposure of swine to a 345-kV ac transmission line in Iowa resulted in no observable effects in exposed animals relative to control animals (Mahmoud, Zimmerman, and Cowan 1982; Mahmoud and Zimmerman 1984). Body weight, carcass quality, behavior, feed intake, pregnancy rate, frequency of birth defects, birth weight or weight gain of young were investigated. Electric field exposures ranged from 3.5 to 4.1 kV/m. Magnetic field was not measured. However, the magnetic flux density from the 345-kV line is presumably comparable with those of 230-kV lines: e.g., a maximum of 0.12 G, 120 mG (Lee et al. 1985).

There are no indications that exposures to the fields beneath operating transmission lines affect livestock behavior or productivity. However, both ac and dc currents can cause definite behavioral responses in dairy and beef cattle. For this reason metal

water and feed troughs, like all conducting objects under the proposed line, should be grounded to eliminate the possibility of nuisance shocks.

Microshocks to animals from so-called "stray" or neutral-to-earth voltages have given rise to problems of animal health and production (Gustafson and Albertson 1982). Voltages between a grounded-neutral system and true earth can produce low-level current shocks in and around barns. These shocks can affect livestock, particularly dairy cows, which can apparently perceive a voltage as low as 0.75 to 1 V across parts of the body. The results of these low-level shocks can be a significant loss in production.

Neutral-to-earth voltages have been observed from both on-farm and off-farm sources. The sources are generally related to current flow in the primary distribution and farmstead neutral systems and not to field induction from transmission lines. Similarly, the mitigation of neutral-to-earth voltages involves modifications to the primary neutral system, the farmstead neutral system, the farmstead electrical load, or the conducting surfaces in the affected area (Gustafson and Albertson 1982). Mitigation is done on a case-by-case basis. The effects of "stray" voltages are considered an electrical distribution system problem and not a transmission line problem.

C.3 Cardiac Pacemakers

Currents and voltages that are introduced internally to the body represent a possible source of interference to cardiac pacemakers. Internal currents can be caused by electric fields, by magnetic fields, or by direct contact. In the last case, the person might provide a path between a large vehicle under a transmission line and ground, or between an appliance with inadequate grounding and ground.

Recognition of and concern for the possible effects on pacemakers from transmission line electric and magnetic fields has led to considerable research on this topic in the last decade. A study at the University of Rochester will expose pacemaker patients to electric fields in a substation under medical supervision. Possible effects of transmission lines on pacemakers have been addressed in the reviews/hearings conducted in New York, Minnesota, Michigan, and California.

The conclusion drawn from the research and reviews is that the overall risk to pacemaker wearers from transmission lines is minimal. This is especially true of 115-kV and 230-kV lines like the proposed Carter Mt.-Thermopolis Line, because of the relatively low electric fields when compared to 500 and 765-kV lines. The threshold for interference to the most sensitive pacemakers is estimated to be 3.4 kV/m. Reversion of pacemakers is the most substantial effect noted to wearers of pacemakers and is not considered a serious problem. To date, there is no evidence that a transmission line has caused a serious problem to the wearer of a pacemaker.

C.4 Hazards

The greatest hazard from a transmission line is direct electrical contact with the conductors. Therefore, extreme caution must be exercised when operating vehicles and equipment for any purpose in the vicinity of a transmission line.

In a high electric field, it is theoretically possible for a spark discharge from the induced voltage on a large vehicle to ignite gasoline vapor during refueling. However, the probability for exactly the right conditions to occur is extremely remote. For the proposed line, the maximum electric field is low enough that it is very doubtful the right conditions could ever be achieved (BPA 1979; Basin undated).

Because of the hazards associated with fires, Western prohibits storage of flammables, construction of flammable structures, and other activities that have the potential to cause or provide fuel for fires on ROWs.

Transmission line structures, wires, and other tall objects are likely points to be hit by lightning during a thunderstorm. Therefore, the area near structures and other tall objects should be avoided during thunderstorms. The proposed line is designed with overhead ground-wires and well-grounded structures to protect the system from lightning by routing a strike to the earth.

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APPENDIX D

FLOODPLAINS AND WETLANDS ASSESSMENT

FLOODPLAINS AND WETLANDS ASSESSMENT

D.1 Introduction

Executive Order 11988 mandates that floodplain management and flood hazards be considered in planning projects. Pursuant to DOE's "Compliance with Floodplain/Wetland Environmental Review Requirements," 10 CFR 1022, Western has determined that this project would involve activities within a floodplain area. Public meetings were held and the public was informed of potential activities in the floodplain. Floodplains are defined as lowlands adjoining inland waters, and include the area that would be inundated by a 1 percent (100-year) or greater probability flood in any given year. Flood hazard maps are not available for this portion of Hot Springs County, Wyoming (Federal Emergency Management Agency 1991). However, the character of at least one stream crossed by the project (Owl Creek) fits DOE's definition of a floodplain.

Executive Order 11990 mandates that government agencies consider preservation of wetlands in planning and management actions. Wetlands are defined by the U.S. Department of Energy as areas inundated by surface or groundwater with a frequency sufficient to support vegetation or aquatic life requiring saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands include swamps, potholes, marshes, bogs, sloughs, floodplains, lakes, reservoirs, and springs. For this project, wetlands are limited to the floodplain meadows/marshes and riparian vegetation associated with primarily perennial streams.

The following constitutes the floodplains-wetlands assessment for the Carter Mountain-Thermopolis 230-kV Transmission Line Project. Detailed descriptions of the proposed project and existing environment, impact assessment, and maps of the project area are provided in the environmental assessment (EA).

D.2 Floodplains and Wetlands in the Project Area

Four perennial streams are located in the study area. These streams originate in the Absoroka Mountains and flow east into the Yellowstone and Missouri River systems (BLM 1981, Peterson 1988). Several small ephemeral or intermittent drainages are also present in the study area. Floodplains occur along the lowlands adjoining these perennial streams; Owl, Cottonwood, Grass, and Gooseberry Creeks.

The floodplains along the perennial channels in the study area range from approximately 0.6 to 1.5 miles in width, with the largest floodplain occurring along Owl Creek in the southern

portion of the study corridor. Floodplains were identified using high altitude aerial photographs, low altitude videotapes, and field reconnaissance.

The wetland areas in the study area are small and scattered along the riparian drainages. Intermittent streams that flow long enough to support riparian vegetation generally contain at least 10 times the amount of wetland habitat as do the perennial streams in the BLM's Grass Creek Resource Area (BLM 1982). However, in the study area, wetlands are limited to the perennial drainages. The intermittent drainages are generally too dry and ephemeral to support vegetation. Many of the wetlands have been decreased in quality and size due to grazing pressure along the streams (BLM 1982). Many of the historical wet meadows and marshes have been converted to hay fields.

The largest floodplain in the study corridor occurs along Owl Creek approximately 4 miles northwest of Thermopolis, Wyoming. The Owl Creek floodplain is a broad valley ranging from 0.5 to 1.5 miles in width. Much of the valley floor is in grass and hay production. Many small tributary channels meander through the hayfields. The channels support perennial flows and are lined with shrubs, primarily greasewood and willows. Historically, the valley floor may have supported wet meadows and fresh water marshes. Currently, no wetland habitat (besides streamside willows) occurs along either the existing or proposed transmission line alignments.

The next largest floodplain occurs along Grass Creek. Grass Creek is a tributary to Cottonwood Creek. In the project corridor, the valley floor is about 0.5 mile wide and is occupied by extensive shrub flats of greasewood. The rebuilt transmission line would follow the existing alignment across Grass Creek. The route crosses two channels of Grass Creek, one flowing and one dry. At the southern crossing near Highway 171, Grass Creek is perennial and flows through small sand bars and thick grasses. At the northern crossing near Highway 120, Grass Creek is a dry gully. Stream banks are deeply encised and eroded with a few scattered shrubs. The existing transmission line access road crosses this dry wash. No wetlands occur at the Grass Creek crossing. Cottonwood Creek is crossed by the existing transmission line just west of the Highway 120 bridge. The proposed route would follow the existing transmission line route. Cottonwood Creek is only 500 feet wide at the transmission line crossing and is spanned by the existing line. Channel banks are moderately sloped with two perennial channels flowing along the edges of the banks. Right-of-way (ROW) access roads do not cross Cottonwood Creek. Riparian/wetland vegetation is limited to the thick grasses lining the channel bottom.

Floodplains along Gooseberry Creek range from 500 feet to approximately 0.5 mile wide. The existing Carter Mountain-Thermopolis line crosses the stream near the Highway 120 bridge. At this location, five transmission line structures occur in the floodplain. The main channel is lined by willows and several cottonwood trees occur nearby. The main channel is spanned by the existing line.

The new proposed floodplain crossing is about 1 mile west of the existing crossing. At this location, Gooseberry Creek is only 500 feet wide. Access is available to both sides of the floodplain from existing roads. The channel at this location is occupied by dense willows and a single cottonwood. No wetlands occur at the existing or proposed crossings.

D.3 Floodplains and Wetlands Effects

The floodplains located along Owl, Cottonwood, Grass, and Gooseberry Creeks are the only floodplains potentially impacted by the proposed transmission line. All of the intermittent drainages crossed by the project would be spanned. Existing access roads would be used and construction would occur during dry conditions. No impacts to intermittent drainages is anticipated.

Approximately five new transmission line structures would be required to cross Owl Creek along the new proposed alignment. Existing access is available to this crossing along Tri-State's existing 115-kV transmission line. Western's new line would parallel this crossing. The main channel would be spanned and no riparian vegetation would be removed. Construction would be timed to minimize impacts to hay production. Surface disturbance associated with the construction of the transmission line structure, and the physical presence of the structures during operation are not expected to measurably alter the floodplain storage volume or cause an increase in flood stage.

Fifteen structures along the existing Carter Mountain-Thermopolis Transmission Line ROW would be removed from the Owl Creek floodplain. Structures would be removed using existing access. Removal would be timed to minimize impacts to fields and hay production. Overall, 10 fewer structures would be present in the floodplain at this location. No adverse impacts to floodplains or wetlands at Owl Creek are anticipated.

Grass Creek floodplain and wetlands would not be significantly impacted by the new transmission line. The new line would follow the existing transmission line ROW, construction would include removal and replacement of old structures with new structures. Existing access would be used during construction. Access across flowing channels is not necessary and would not occur. The main flowing channel and dry channel at Grass Creek would be spanned.

At Cottonwood Creek, the rebuilt line would cross at the same location as the existing transmission line. The floodplain would be completely spanned. Existing access is available

to both sides of the crossing. No adverse impacts to the floodplain or wetlands at Cottonwood Creek are anticipated.

At Gooseberry Creek, the proposed route would span the 500-foot-wide floodplain. Existing access is available at this location. Access across the flowing channel is not necessary. No riparian or wetland vegetation would be removed by construction. At Gooseberry Creek, five structures on the existing ROW would be removed from the floodplain. Existing access would be used to remove structures. Construction would be timed to minimize impacts on hay production.

In summary, Grass and Cottonwood Creeks would be spanned. The transmission line would span all flowing and dry channels of perennial and intermittent streams. Riparian vegetation would not be removed. The contractor would use existing access and would be prohibited from crossing live streams or staging in wetlands or floodplains. No removal of vegetation for routine maintenance is necessary. Fifteen fewer structures would be located in floodplains at Owl and Gooseberry Creek as a result of construction of the proposed project. Impacts to the floodplain would be minimal.

The final design for the transmission line structures located in the floodplain would include foundation design that considers site-specific soil conditions, as well as elevation of the 100-year flood and potential debris loading at each structure during flooding. Therefore, failure of a structure during a flood is not expected. No watercourses would be altered or relocated as a result of the project. No applicable state or local floodplain protection standards would be violated. Public meetings were held during the preparation of the environmental assessment and the public was informed of potential activities in the floodplain. Therefore, construction and operation of the transmission line would substantively comply with DOE floodplain and wetland environmental review requirements.

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